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DEPARTMENT OF FISH AND GAME

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**SB 34 DELTA LEVEES  
MASTER ENVIRONMENTAL ASSESSMENT**



**October 1995**

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## SUMMARY

The Master Environmental Assessment (MEA) summarizes "environmental values" of the Delta. It should be viewed as a general profile of these values in the mid-1990s.

The status of fish and wildlife values in the Delta are subject to constant change. Much Delta habitat is established or lost fairly quickly, such as the constant cycle of removal and regrowth of vegetation on Delta levees. Changes in agricultural crop patterns and in the status of Threatened and Endangered species, as well as creation of new fish and wildlife mitigation areas and other activities, make the task of describing the status of these values all the more challenging. Considerable effort was spent updating existing information, including the status of Endangered and Threatened species.

The MEA describes the diversity of habitats in the Delta, as well as the species and assemblages of species of plants and animals which use them. Open water, levees, lakes and ponds, and agricultural fields are examples. Among the most valuable wildlife habitats in the Delta are the channel islands. These areas tend to be relatively free from human disturbance. However, they are diminishing in area from wave erosion and many islands are gone.

The MEA has been prepared with the main goal of serving as a reference document for SB 34 work, helping to enable determinations of cumulative impacts and "no net long-term loss" determinations from projects. It will, along with many other reference documents describing the Delta, serve this purpose. However, project sponsors should be aware that the MEA is only a reference document and it will not replace necessary surveys or other documentation under the California Environmental Quality Act (CEQA) or other laws.





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## I. INTRODUCTION

### A. Elements of an MEA

A generic discussion of an MEA is located in Section 15169 of the CEQA guidelines: "... A Master Environmental Assessment is suggested solely as an approach to identify and organize environmental information for a region or area of the State". An additional mandate dealing with the content of this MEA is described in an interagency Memorandum of Understanding (MOU), described in Section B.

There is the potential for a large amount of flexibility in the content of an MEA. Section 15169, does specify the following:

"A public agency may prepare a Master Environmental Assessment, inventory, or database for all, or a portion of, the territory subject to its control in order to provide information which may be used or referenced in Environmental Impact Reports (EIRs) or Negative Declarations (NDs). Neither the content, the format, nor the procedures to be used to develop an MEA are prescribed by these Guidelines."

Sections 15169 (a)-(c) states that an MEA can serve almost any purpose. However, the CEQA guidelines go on to state what an MEA may contain, including an inventory of the physical and biological characteristics of an area as well as any additional information deemed necessary to describe the environmental characteristics of an area.

An MEA is not a substitute for an EIR; it is for informational purposes only, and is strictly advisory in nature. Reclamation districts in the Delta may have to prepare additional CEQA documentation for their projects using information in the MEA. Section 15065 of the CEQA guidelines outlines those situations under which an EIR (or ND) will be required. In particular, attention should be paid to the requirement of Section 15065 (a). This section refers to projects with the potential for reducing the number or range of a rare or endangered species. Section 15169 (d) of the CEQA guidelines states that an MEA can provide information for use in preparing individual EIRs and NDs.

The "Delta Wildlife Habitat and Protection Plan" (Madrone Associates, 1980) provides a comprehensive, if somewhat outdated, overview of Delta fish and wildlife values. Because of this, the MEA follows the basic framework of this plan. Much of the information has been updated, particularly those sections dealing with biological resources and Special Status species.

## **B. Goals and Objectives**

### **1. Satisfy Mandates**

The specific content requirements for this MEA, above and beyond those described in the CEQA guidelines, are in the interagency MOU. The MOU is a binding document between the California Department of Fish and Game (DFG), the California Department of Water Resources (DWR), the State Reclamation Board, and the State Resources Agency.

In addition to mandating the MEA, the MOU requires the Resources Agency to appoint a Habitat Advisory Committee. This committee consists of flood control, environmental, legislative, and agricultural interests and provides a forum to resolve issues related to the MOU's implementation. The advice of this committee must be consistent with the other provisions of the MOU, including the following specific requirements relative to the content of the MEA:

- a. It is to be an overview of "Delta-wide environmental values". This, above all else, is what the document is mandated to be.

The reference to "environmental values" is interpreted to include general items such as the status of Delta plant, fish, and wildlife populations. It also includes the physical features which affect these populations, including soils, water, levees, lakes, channels, and other elements.

- b. The MEA develops a "menu" of possible mitigation measures for use in Delta Flood Protection Act of 1988 (SB 34) programs. Because this is a mitigation issue, it has been determined that this menu should be within the May 1995 Mitigation Guidance Document (MGD) for the SB 34 program.

### **2. Primary Goals**

The main goal of the MEA is to serve as an assessment of environmental resources which can affect, or be affected by, flood control activities funded under the SB 34 program. The scope of the MEA encompasses all fish and wildlife resources of the statutory Sacramento-San Joaquin Delta, irrespective of whether these resources are likely to be directly affected levee maintenance and or associated impacts from the SB 34 program. This will fulfill the mandate of the MOU. It will provide a basis for determining the cumulative positive or negative environmental impacts, if any, of a given Delta project. It will, in conjunction with the SB 34 mitigation guidance document, be used to determine whether such activities result in a net long-term loss of fish and wildlife habitat, as described in the MOU. It will also be useful in determining the cumulative impacts, if any, from such projects to fish and wildlife resources of the Delta. Information in the MEA may be used by SB 34 participants to prepare any necessary environmental documentation for their levee maintenance and rehabilitation work.

### **3. Provide Miscellaneous Benefits**

The MEA will also provide various incidental benefits:

#### **a. Assists in State and Federal Endangered Species Act Compliance.**

The MEA contains a current inventory of State and Federal Special Status species in the Delta. Reclamation districts and other project applicants will use this information to help insure their proposed actions do not jeopardize the continued existence of these species.

#### **b. Program Policy Venue**

The assessment contains information useful for the enhancement of cooperation among local governments and State and Federal agencies. Five counties and seven incorporated cities, as well as State and Federal agencies exercise regulatory and other types of authority in the Delta. The Delta-wide description of environmental values in the MEA will facilitate planning among these entities.

#### **c. Delta-wide Planning Tool**

The MEA outlines methods for the protection of natural resources, which have the potential for connecting the policies of local plans with the legislated authorities and policies of the U.S. Fish and Wildlife Service (USFWS), DFG, U.S. Army Corps of Engineers (COE), DWR, and other public resource agencies.

#### **d. Tool for Zoning**

The MEA provides a resource for local governments of the Delta to use when adopting open space conservation elements of their general plans and thus protecting such areas with appropriate zoning. The MEA will enable the existing classification of State lands in the Sacramento-San Joaquin Delta to be reevaluated for possible reclassification to more effectively protect areas possessing significant environmental values.

#### **e. Plan Development**

The MEA provides a basis for the future design of comprehensive management plans, (e.g., for nongame birds using marsh or riparian habitats, or for waterfowl using Delta tule marshes and agricultural habitat). The information is useful for participants in a variety of State, Federal, and local wetland protection programs.



## **C. Relationship between the MEA and Existing Resource Documents.**

### **1. Mitigation Guidance Document (MGD)**

The MOU specifies that the MEA will also serve as a background resource document for the MGD. The main goal of the MGD is to provide a reference guide for mitigation developed by flood control reclamation districts that participate in SB 34 funded programs. It will be used to avoid, minimize, or compensate for unavoidable adverse impacts from levee maintenance activities. The MGD is dated May, 1995.

### **2. Other Documents**

There are various other documents which discuss Delta habitat values. There have been many specialized investigations and subsequent reports of Delta habitats. These include the Ecological Studies of the Sacramento-San Joaquin Delta (Skinner, 1972), environmental impact studies in connection with the Peripheral Canal, Delta Levee Investigation (DWR, 1982), COE's Environmental Atlas (1979), and many others which are discussed and referenced in this document. The MEA provides a comprehensive, current overview and description of Delta wildlife resources, their relationship to the forces of change in the Delta, and the outlook for long-term protection and restoration.

Before 1978, little work had been done to inventory terrestrial habitat in the Delta. Only Delta fishes and their aquatic habitats had been thoroughly documented. At that time the COE inventoried and mapped terrestrial habitat types, using vegetation and floristics as a basis for classification. This work resulted in the Delta Environmental Atlas (COE, 1979).

Other plans are also descriptive of the Delta and should be used as companion documents. The Delta Master Recreation Plan (DMRP) was first issued by the Resources Agency in 1966, and was issued again in 1973. It defined State policy for the Delta, setting forth a main goal to protect and develop the Delta's scenic, wildlife, and recreational resources. The accompanying Waterway Use Plan was designed to guide and control development along Delta waterways. Both the DMRP and Waterway Use Plan were updated in 1976. The DMRP identifies most of the problems and conflicts which are identified in this MEA and recommends solutions for problems associated with land use, transportation, levees, recreation, waterway use, and fish and wildlife.

The importance of the DMRP to the MEA lies in its comprehensive coverage of Delta resources. Fish and wildlife are only one of the DMRP's concerns. Other concerns include consistent expression of State policy for natural and cultural resources in the Delta; and in its potential utility as the political and legislative means by which to implement the recommendations.

The Delta Advisory Planning Council (DAPC) Delta Action Plan (1975-76) anticipated the need for a planning document such as the MEA and stimulated the counties and communities

of the Delta to recognize the need for a common plan to protect the diminishing natural and historic resources of the Delta. Much resource information was compiled in DAPC Plan Technical Supplements, but no new fish and wildlife information was contributed. Significant resource areas were identified in that plan. They form the basis for a similar list in the COE's Delta Environmental Atlas (COE, 1979), and this MEA.

The Waterways Use Program, along with a Waterway Use Plan Map, classifies waterways as "Natural," "Scenic," or "Multiple Use" areas and establishes policy, use restrictions, and development standards for each category. The program has been adopted in principle and applied with some success by State, Federal, and some local agencies, but with varying interpretation as well as application.

Recently prepared resource documents include the technical reports recently produced by the Delta Protection Commission and the Bay Delta Oversight Council.

#### **D. SB 34 Program**

##### **1. Program Overview**

SB 34 increased the financial assistance to Delta flood control reclamation districts maintaining nonproject levees (those levees not classified as project facilities under the State Water Resources Law of 1945) (Figure 1). The Delta Flood Protection Act of 1988 amended Section 12987 of the California Water Code. The Act states the Legislature's intent to appropriate to the SB 34 Program \$120 million over a 10 year period. A total of 55 reclamation districts are eligible for participation. Maintenance of the Delta levees protects farmland and urban areas from flooding and preserves the existing channels of the Delta as conveyers of water for State and Federal water projects. It also protects wetlands, uplands, and other fish and wildlife habitat areas from flooding.

##### **2. Background to Passage of Current Legislation**

Between 1980 and 1986 levee breaks have occurred on 24 Delta islands. They were partially or completely flooded, costing about \$100 million to recover property and complete repairs. SB 34 was passed after the 1986 floods. It provides up to \$120 million for 10 years. SB 34 amended language in the Water Code, related to administration of the Delta Levee Subventions Program. It contained a mandate to the DFG that no net long-term loss of habitat would be due to the subventions program.

- a. Increased the maximum annual program funding from \$2 million (in the Way Bill) to \$12 million.
- b. Increased the maximum share of State reimbursements for levee maintenance from 50 to nearly 75 percent.

- c. Contained provisions for advances (up to 75 percent of State share).
- d. Coincided with DWR Bulletin 192-82 (Delta Levees Investigation).

The only authority for State financial assistance for the maintenance of nonproject Delta levees was the Way Bill, prior to the passage of SB 34,. This subvention program disbursed up to \$2 million per year for levee maintenance. This level of funding was inadequate for the required flood control. The need for additional funding for levee repair became particularly acute after the flooding of the town of Thornton and Tyler Island in 1986.

The main reason for the enactment of SB 34 was to assist the reclamation districts in achieving compliance with 1983 Flood Hazard Mitigation Plan (HMP) criteria, as subsequently updated in 1986. The Federal Emergency Management Agency (FEMA) is requiring the districts to comply with HMP criteria to retain eligibility for Federal Flood disaster assistance.

### **3. Program Components**

The program is implemented by two programs. These include (1) the Delta levees Maintenance Subventions Program and (2) Special Flood Control Projects Program components.

The legislation contains provisions for local reclamation districts to pay the first \$1,000 for each mile of levee maintenance and rehabilitation, and to pay up to 75 percent (up from 50 percent) of the cost exceeding \$1,000 per mile.

The program ends on December 31, 1998.

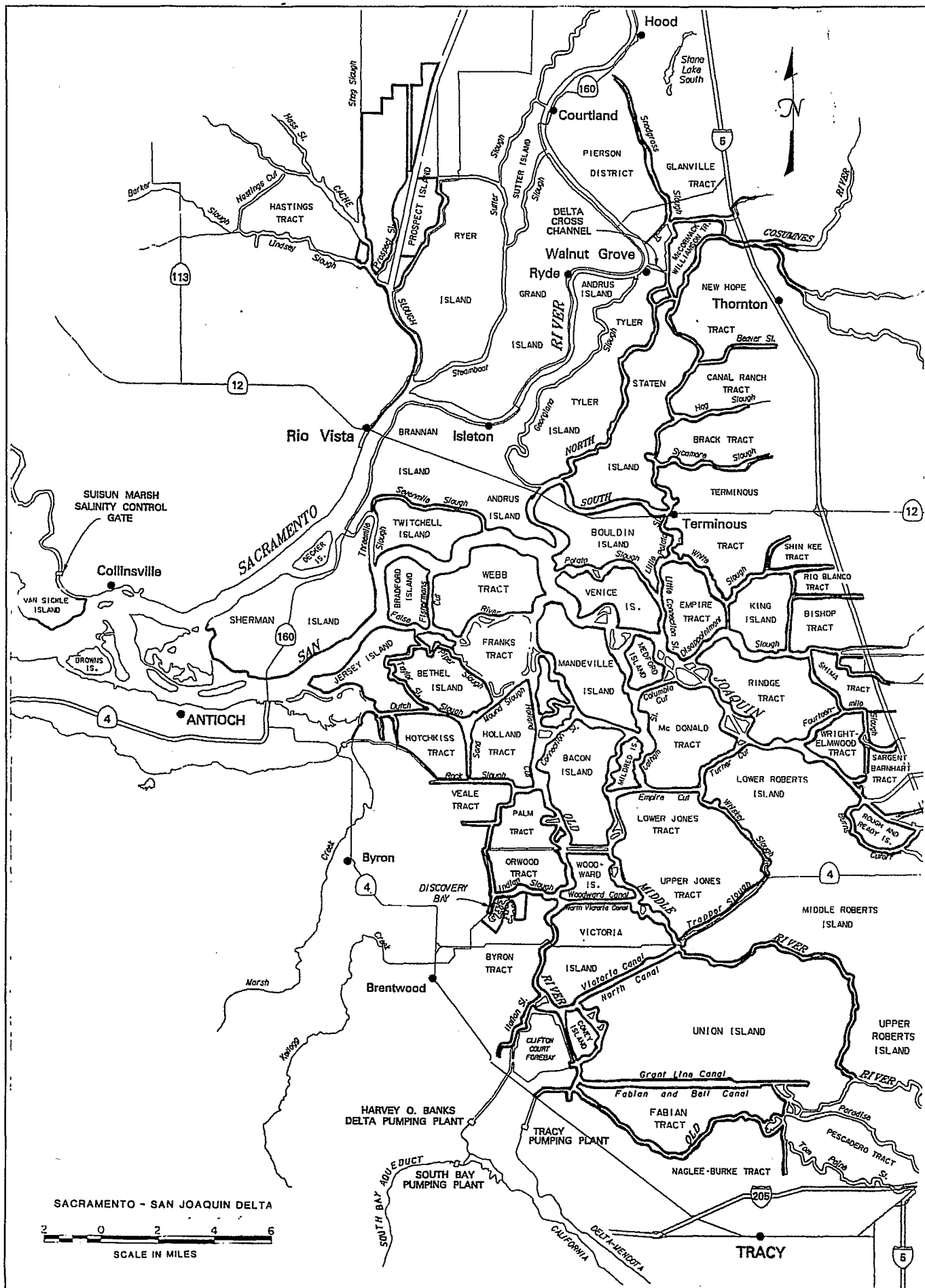
#### **a. Delta Levee Subventions**

The subventions program reimburses local flood control agencies for the maintenance and improvement of local levees. The SB 34 program requires that the reclamation districts provide annual workplans. These shall not result in a net long-term loss of habitat. Responsibilities of the various participants in the program are identified in the interagency MOU. Up to \$6 million a year is available for disbursement to all participating levee reclamation districts, depending upon legislative appropriation. This includes those eligible for funding by Special Flood Control Projects for other purposes. This is managed by DWR's Central District office.

#### **b. Special Flood Control Projects**

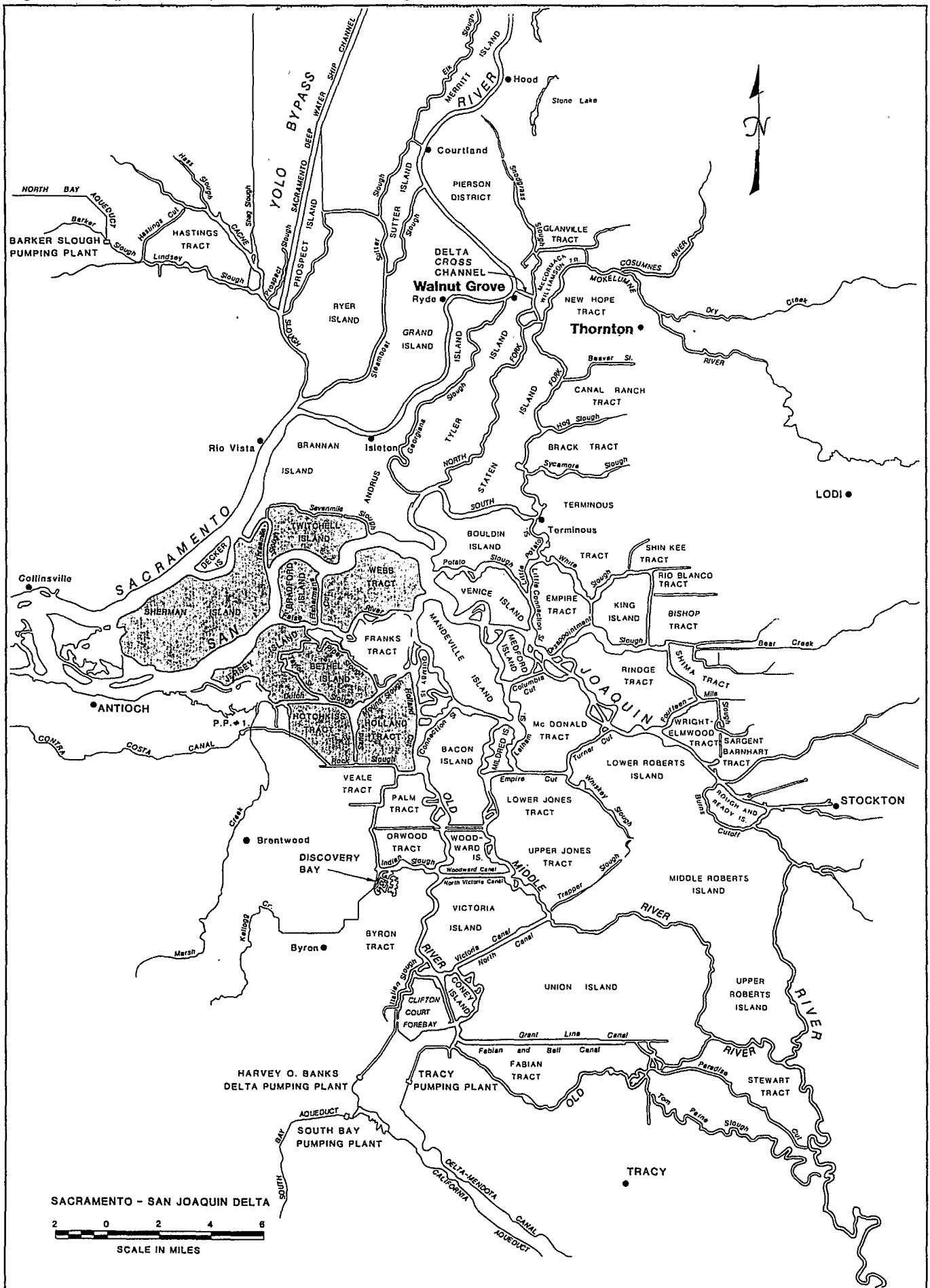
The program is responsible for developing and administering flood control projects on Bethel, Bradford, Jersey, Sherman, and Twitchell Islands and Holland, Hotchkiss, and Webb Tracts (Figure 2), and for the towns of Thornton and Walnut Grove. It also funds flood

Figure 1. Local Flood Control Nonproject Levees



Source: Department of Water Resources, Sacramento-San Joaquin Delta Atlas, 1993

Figure 2. Special Project Jurisdiction, Eight Western Islands



Source: Department of Water Resources, Sacramento-San Joaquin Delta Atlas, 1993

control projects and soil subsidence studies and monitoring at these locations.

Protection of these islands from flooding is critical for maintaining water quality in the Delta, particularly for the State Water Project (SWP). There are also benefits of this program because it protects public highways and roads, utility lines, conduits, and other facilities, fish and wildlife habitat, farmland, and urbanized areas. Up to \$6 million a year is available for this program. This program is managed by DWR's Division of Planning. Again, this funding depends upon legislative approval.

#### **4. Subventions Program Oversight**

SB 1065 gave the Resources Agency an oversight responsibility. The Resource Agency formed the Delta Levees Habitat Advisory Committee to oversee those aspects of SB 34 agriculture program which are outlined in the MOU. The committee has since held regularly scheduled meetings to discuss and resolve program issues. The Committee was formed as a forum where flood control, and other interests confer on a regular basis to help insure that the SB 34 program is meeting its objectives. The recommendations of the Committee do not supersede the mandates of the MOU or the authority of the agencies signatory to the MOU.

#### **5. Division of Responsibilities for SB 34 Program Implementation**

The involvement of State and Federal agencies in the review and implementation of SB 34 depends on the nature of each maintenance or rehabilitation project. The presence of Special Status species on either the landside or waterside of the levees may trigger action by the DFG, USFWS, National Marine Fisheries Service (NMFS), COE, or other agencies.

##### **a. State Responsibilities**

The State will provide reimbursement funding, as available, through the SB 34 program for levee rehabilitation and maintenance. The responsibilities for flood control maintenance in the program are shared between the DWR, the State Reclamation Board, and the Resources Agency, and are spelled out in the current interagency MOU. The State Lands Commission (SLC) and the Regional Water Quality Control Board (RWQCB) may also have jurisdictional responsibilities for work on levees.

The DFG is responsible for reviewing all annual workplans for levee maintenance under SB 34 to ensure that no net-long term loss of fisheries, riparian, or wildlife habitat occurs from SB 34 funded levee maintenance or mitigation activities.

##### **b. Local Reclamation District Responsibilities**

Local flood control reclamation districts are government agencies and are directly responsible for bringing all nonproject levee up to HMP standards. The districts must acquire the necessary data, engineering surveys, and geotechnical information to ensure that the levee

work does not result in unusual or unexpected subsidence of the levee, breaching of the levee, or subsequent damage to improved private and/or public facilities. Reclamation districts are responsible for submittal of complete applications to the DWR in order to participate in the annual levee Subventions program. Furthermore, they are responsible for submitting claims to DWR for the levee work that was completed.

**c. Federal Responsibilities**

FEMA guidelines have been developed which require that levees meet a minimum HMP standard as a condition of eligibility for disaster assistance. This is not an SB 34 assigned responsibility. Also, the Federal government enforces the Endangered Species Act (ESA). Work in waters of the U.S. may initiate the COE involvement under the Clean Water Act.

## **II. PHYSICAL AND GEOGRAPHICAL SETTING**

### **A. Terrestrial Boundaries**

The "Legal Delta" encompasses 1,153 square miles, or 738,000 acres (Figure 3). The Legal Delta is located within six counties: Contra Costa, Sacramento, San Joaquin, Solano, Yolo, and Alameda.

The Delta is separated geographically from San Francisco Bay by the hills of the Coast Range on the west; on the east it is bounded by the outwash plains of the Sierra Nevada foothills. At the north and south there are no topographic features to define its limits, although the cities of Sacramento and Tracy coincide with the approximate northern and southern extremities of the marshes and overflow lands which characterized most of the region before its reclamation.

The MEA addresses that region of central California where most of the major California rivers converge, including the Sacramento and San Joaquin, the Mokelumne, Cosumnes and other tributaries. It forms an inland, 1,150 + square mile delta-like network of sloughs and islands roughly 50 miles northeast of San Francisco.

The Delta has 700 miles of meandering waterways. It provides an abundance of fish and other aquatic life. The Delta is a deep water transportation corridor for commercial navigation interests. It has direct access between the Pacific trade routes and the Sacramento and Stockton inland ports. It is interconnected with quiet sloughs and backwaters for thousands of recreationists. This provides hundreds of square miles of water surface for boating, water skiing, and shoreline recreation.

### **B. Relationship to the Upstream and Downstream Aquatic Environment**

The Delta is part of the San Francisco Bay/Delta Estuary. Estuaries are among the world's richest and most productive ecosystems. The meeting of fresh water from the land with salt water from the ocean supports high rates of biological productivity, as evidenced by the abundance and diversity of plants, fish, birds, and other life. Ecologically, the Delta is distinct from most of the rest of the Estuary in that it is essentially a freshwater system.

The Sacramento-San Joaquin Delta occupies the strategic position of convergence of waters draining more than half of California. This comes from a drainage that receives almost no rainfall for half of the year.

The many waterways of the Delta come together near Antioch and flow west through Carquinez Strait to San Pablo and San Francisco bays. A long salinity gradient through Carquinez Strain and Suisun Bay defines both the linkage and the transition between the Bay and the Delta. Geomorphologically, it is not a true delta. The hydrology of the Delta



contrasts with the outflow pattern of most other deltas, where channels split and spread over a broad floodplain.

The Delta is part of the larger San Francisco Bay-Delta ecosystem. It is hydraulically connected and many of the fish and wildlife species found in the Delta are also found in other waters in this system, such as San Francisco and San Pablo Bays. Any study of one, to be complete, must include, or at least acknowledge, the other.

### **C. Water Systems**

The Delta is an inland triangular network of waterways formed about 6,000 years ago. The streams and rivers that flow together to form the Delta drain a 61,200 square mile watershed of the Central Valley, which represents around 37 percent of the State's land area (Madrone, 1980).

The main channels of the Delta, such as Old River, Georgiana Slough, and the North and South Forks of the Mokelumne River, function partly as conduits for water for the SWP and the Federal Central Valley Project (CVP).

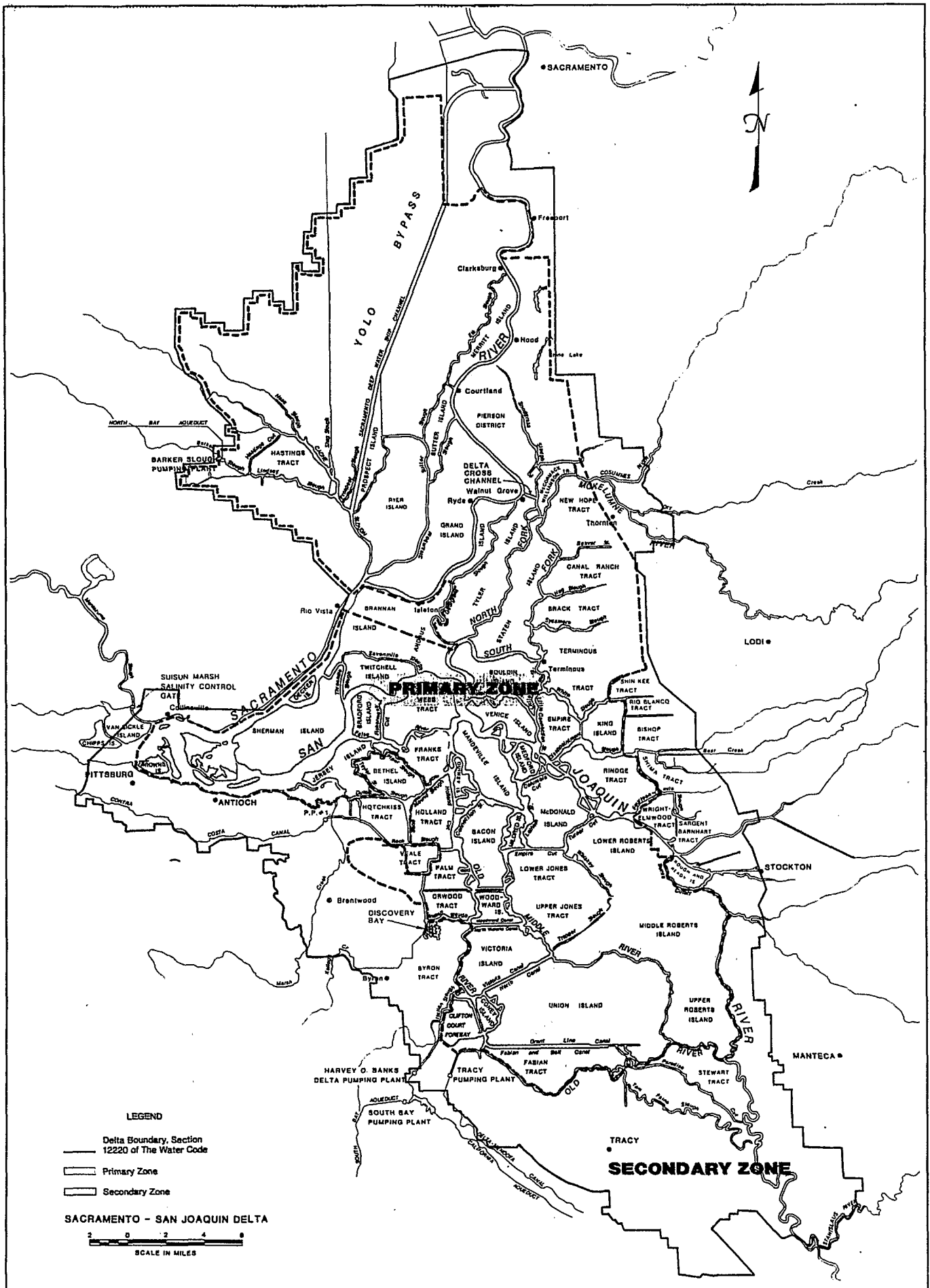
The most important environmental factors affecting biological systems in the Delta, like in all estuarine systems, have to do with its waters, especially circulation, temperature, salinity and their temporal and spacial variations. As indicated, the major determinants of Delta water characteristics at any point in time are the tides, river inflows and water diversions from the Delta.

Saline water from the ocean tides meets freshwater flows from the rivers, creating particular patterns of water circulation. At the point where salinity is about one to six parts per thousand (ocean seawater is 30-33 parts per thousand), incoming and outgoing currents on the bottom tend to cancel each other out. This area is called the "null zone." The null zone creates a region where suspended nutrients tend to accumulate, as do phytoplankton, zooplankton, and eggs and larvae of many fish. This "entrapment zone", just downstream of the null zone, is the site of much biological activity (Arthur and Ball, 1979).

The location of the entrapment zone is determined by the amount of freshwater flow through and out the Delta. With very high flows the entrapment zone is in San Pablo Bay or the Carquinez Straits, with moderate flows it is in Suisun Bay, and with low flows it moves upstream into the lower Sacramento River (Arthur and Ball, 1979). When the entrapment zone is located in the warm, shallow waters of Suisun Bay during spring, summer and fall, it appears that planktonic food chain dynamics are most favorable for many Delta fish species. When the entrapment zone is further inland in narrow river channels with cooler temperature and decreased residence time, ecosystem productivity is diminished.

Delta hydrodynamics must be considered in developing solutions to issues of sustaining and restoring fisheries, water quality and other uses of the Delta's limited freshwater resources.

Figure 3. Legal Delta, Primary and Secondary Zones



Source: Department of Water Resources, Sacramento-San Joaquin Delta Atlas, 1993

Delta hydraulics are influenced by freshwater inflow from tributary streams, Pacific Ocean tides, water uses in and exports from the Delta, and morphology — the configuration and geometry of Delta channels.

As of 1980, slightly under 80 percent of the Delta's waters were tidal, and the remainder made up of lakes, ponds, and nontidal sloughs. The tidal areas rise and fall with two tide cycles each day. The Delta water is fresh, dominated by river inflow. However, with very low Delta outflow, western Delta salinity can reach 6 parts per thousand.

The amount of water in Delta channels varies each day within the limits of the ebb and flow of the tide. Water levels in the channels cannot decrease significantly below low tide levels because inflow caused by higher water levels in Suisun Bay will make up the difference. Suisun Bay water is quite saline and brackish.

An enormous volume of salt water moves back and forth within the Bay-Delta Estuary each day. Its tidal prism averages 1,250,000 acre-feet or nearly one-fourth its total volume. In contrast, its average daily freshwater inflow is 50,000 to 60,000 acre-feet. Water carried into the San Francisco Bay Estuary by the tides is split about equally between its northern and southern reaches, but their tidal patterns are very different. In the northern reach the tidal range is 4.3 feet in Suisun Bay and 3.0 feet in Sacramento, compared to 5.6 feet at the Golden Gate. In contrast, in the nearly enclosed basin of the southern reach, the tidal range is 8.5 feet. In the northern reach, river flow can change radically from year to year, but averages 14 million acre-feet, about 50 percent of the total runoff to the system. The remainder is diverted for agricultural and urban use.

Since about 95 percent of the inflow to the Estuary occurs as runoff, the amount of precipitation in the Central Valley watershed determines the potential flow of fresh water into the Delta. With the exception of wet years, flows into and out of the Delta are completely controlled by reservoir releases and export pumping in the summer and fall. Annual Delta outflow has been reduced by about 50 percent from the estimated natural flow. The spring low peak has been nearly eliminated.



### III. DELTA HISTORY

The historic Delta has been described as consisting of numerous low islands of tule marshes, intersected by miles of river and tributary channels and dead-end sloughs. The lowland marshes and waterways were surrounded by slightly higher seasonal flood plain grasslands and oak savannah. The lower elevation interior of the Delta was covered mainly with a mosaic of tidal and freshwater marshes vegetated with tules and cattails.

The Delta landscape, in its historic condition, was an exceptional ecosystem. The area's early abundance of fish, shellfish and wildlife contributed to its attractiveness to Native Americans as a place to live and to the exploration and settlement of the area by European fur traders. For more than a hundred years, farmers have seen the Delta as a reclaimed lowland containing some of California's most fertile peat and mineral agricultural soils.

The central Delta region was covered by a vast freshwater marsh before human intervention. Much of this land was inundated with each high tide. These tidal marshlands were separated into "tule islands" by many channels and sloughs. Large rivers and streams, entering the Delta region on the north, east, and south created waterways which were bordered by extensive stands of riparian forest growing on naturally deposited levees. The higher ground of the natural levees prevented some overland flood waters from draining into the rivers and created non-tidal marshes and seasonal wetlands in the outer Delta lands. The marsh and riparian vegetation mosaic was surrounded by and intermixed with grasslands, oak woodlands and the continuation of riparian forests upstream on the rivers.

The extent of the marshes, riparian forests, and other habitat types in the Delta as it existed before statehood is not precisely known. It is possible to characterize the historic condition of the approximately 700,000 acres in the Delta from reviews of early maps, old diaries, and other accounts of the region and knowledge of landform and vegetation ecology.

The heart of the Delta was covered by about 350,000 acres of tidal freshwater marsh, criss-crossed by many waterways, including dead-end sloughs. The outer Delta consisted of 200,000 to 300,000 acres of extensive riparian woodlands on natural alluvial levees, nontidal marshes or seasonal wetlands, and some upland grasslands and woodlands (Atwater et al., 1979; Nichols and Wright, 1971; Thompson, 1957).

In the early 19th century, Delta marshes, forests, grasslands and waterways were habitat to more than 250 species of birds and mammals (Madrone, 1980). The region yielded millions of waterfowl and shorebirds, and abundant antelope, tule elk, furbearing mammals and fish. The natural bounty of the ecosystem was evidenced by the large activity in fur trade, market hunting and the commercial fishing industries which rapidly grew up in the Delta with increased European settlement.

Major changes to the ecology of the Delta came with the Swampland Act of September 28, 1850. It gave the State about 555,000 acres of "swamp and overflowed lands" in the Delta. The act allowed the State to offer patents to those who would drain and reclaim river bottom lands, thus encouraging the reclamation of swamp and overflowed lands.

This gave Californian's the impetus to develop these lands into agricultural lands. Subsequently, California passed the Reclamation District Act in 1855, providing for the sale of swamp and overflowed lands.

Reclamation of the Delta began with hand labor by Chinese immigrants, and the pace accelerated with the invention and use of clamshell dredges in the late 1870s. The dredge allowed deep cuts for the building of higher, stronger levees. The first levee was allegedly built on Grand Island in 1849. In the late 1800s and early 1900s, exploitation of fish and wildlife resources peaked, causing severe declines and even local extinctions (extirpations) for many species. Laws which essentially eliminated commercial hunting and fishing and which controlled recreational harvest were eventually enacted to protect remaining resources (Skinner, 1962).

There were also a number of commercial fisheries in the Delta including chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*Oncorhynchus mykiss*), sturgeon (*Acipenser* spp.), striped bass (*Morone saxatilis*) and American shad (*Alosa sapidissima*). Even the extinct thicktail chub (*Gila crassicauda*) was once available in San Francisco fish markets (Miller, 1963 in Moyle, 1976). At the turn of the century, the Delta had more than 25 canneries operating. Soon after the commercial fisheries peaked, fish stocks began declining, particularly the larger fish such as salmon, sturgeon and striped bass. Ultimately, most commercial fishing was banned (Skinner, 1962).

Other human needs and activities conflict with the wildlife habitats which indirectly serve as human amenities. Expanding settlements have directly displaced or compromised the natural conditions of riparian forests on historic floodplains of the peripheral Delta, or they have encroached onto agricultural lands, thus displacing areas of wildlife habitat. Popular recreational facilities and activities have either destroyed, damaged, or disturbed marshes and riparian vegetation, or have necessitated structural reinforcement of levees at the expense of vegetation. Much of the Central Valley riparian forests are now gone, and grasslands have been converted to agriculture. An example is that freshwater and brackish marshes are tempting sites for marinas and other recreational development. Few pristine tidal marshes now remain except for those on channel islands.

A major change in the Delta was the creation of the State Water and Federal Water Projects in the 1960's. The major changes to the Delta are outlined in the following chapter.

#### IV. CURRENT LAND AND WATER USES

##### A. Land Uses

Over the past few decades, many agencies have been involved in the management of land and water resources in the Delta. A general summary of land use in the Delta is shown in Table 1 (DWR, 1993).

The agricultural acreage is irrigated and produces mainly corn, wheat, tomatoes, alfalfa, pasture, sugar beets, safflower and asparagus.

In 1993, a total of 71 percent of the total area in the Legal Delta was classified as agricultural. Almost 83,000 acres were classified as native land, of which about 70 percent were in the Primary Zone (Figure 3). Over 67,000 acres were identified as urban land. Almost 62,000 acres of this land occurred in the Secondary Zone.

Delta communities have sprawled across the flat topography at relatively low building densities, unlike the Bay Area with its geographic constraints. Most people live in unincorporated areas; however, in contrast, 60 percent of Yolo County's population and households are in the two major cities of Woodland and Davis.

The following summaries of Delta land uses is from a land use summary (DWR, 1993) and the background reports on agriculture prepared for the Delta Protection Commission.

Table 1. - Delta Land Use Summary, 1993 (DWR 1993).

County	Agriculture	Urban	Native land	Water surface
Alameda	3,050	202	1,380	44
Contra Costa	55,597	23,816	15,980	17,595
Sacramento	84,094	6,721	13,947	13,832
San Joaquin	253,924	31,072	16,275	16,632
Solano	63,967	598	19,345	8,647
Yolo	66,676	4,809	15,920	4,370
Legal Delta	527,309	67,219	82,846	61,119

## B. Water Uses

Within the Delta, almost all water use is agricultural. Much of the water entering the Delta flows comes from winter rains and spring runoff. Regulated flows also come from reservoir releases in the summer and fall. Delta flows are necessary for the needs of fish and wildlife and are essential in repelling the intrusion of salt water from San Francisco Bay. Current demands on Delta flows come from the SWP, the Tracy Pumping Plant, agricultural interests in the Delta, and urban and industrial water users.

The principal freshwater diversions from the Delta are accomplished by the SWP and the CVP exports. Also, to a much lesser but notable extent, there is a diversion by the Contra Costa County Water District into the Contra Costa Canal. The SWP is operated by the State (DWR). The CVP is operated by the U.S. Bureau of Reclamation. Water for export is pumped from southern Delta channels into the California Aqueduct, the South Bay Aqueduct, the Delta-Mendota Canal and the Contra Costa Canal (Figure 4).

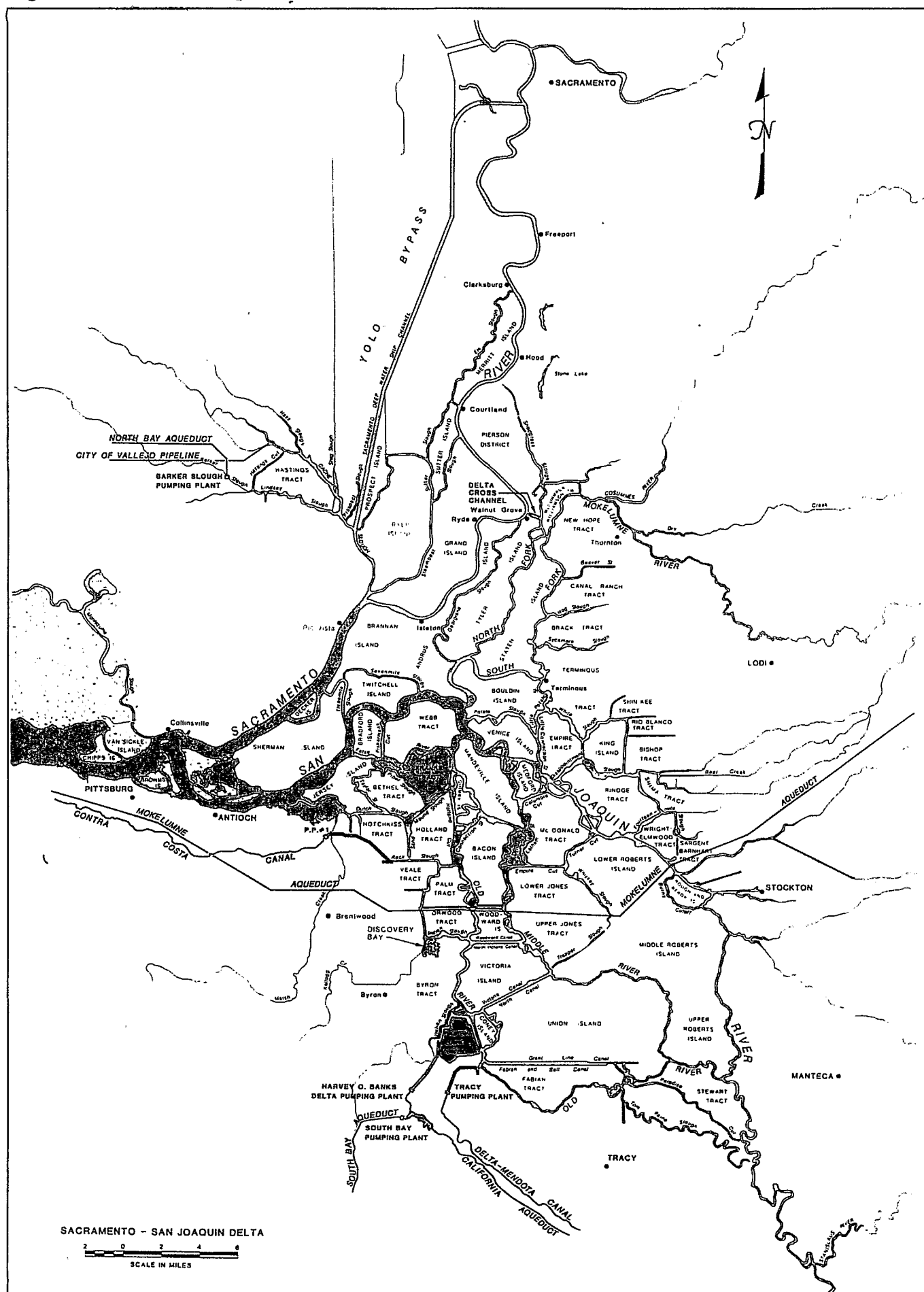
The SWP and CVP must restrict water diversions from the Delta at times. This is necessary to restrict Delta salinities to levels established by the State Water Resources Control Board (SWRCB) in Decision 1485 as a condition of the water rights permits. SB 34-funded levee maintenance helps protect the levees systems, without which large additional flooded areas would exist. The water quality and quantity provided to the SWP and CVP would be adversely impacted if there was a failure in the levee systems.

In addition to regulating flows, the State and Federal projects divert large volumes of fresh water from the Delta and its tributaries. Irrigation diversions remove vast quantities of water throughout the Delta (Figure 5). These diversions range from a few cubic feet per second (cfs) at small farm diversions to a diversion capacity of 10,300 cfs for the SWP at Clifton Court Forebay.

Diversions within the region and upstream also impact the Delta. A reported 1,800 agricultural diversions within the Delta divert about 960,000 acre-feet annually. None of these agricultural diversions are screened to prevent impacts on fish and their eggs and larvae, with the exception of an experimental rotating fish screen at Bacon Island. Upstream diversions account for 9 million acre-feet of water, about one-third of the Delta's annual inflow, that would otherwise flow through the Delta.

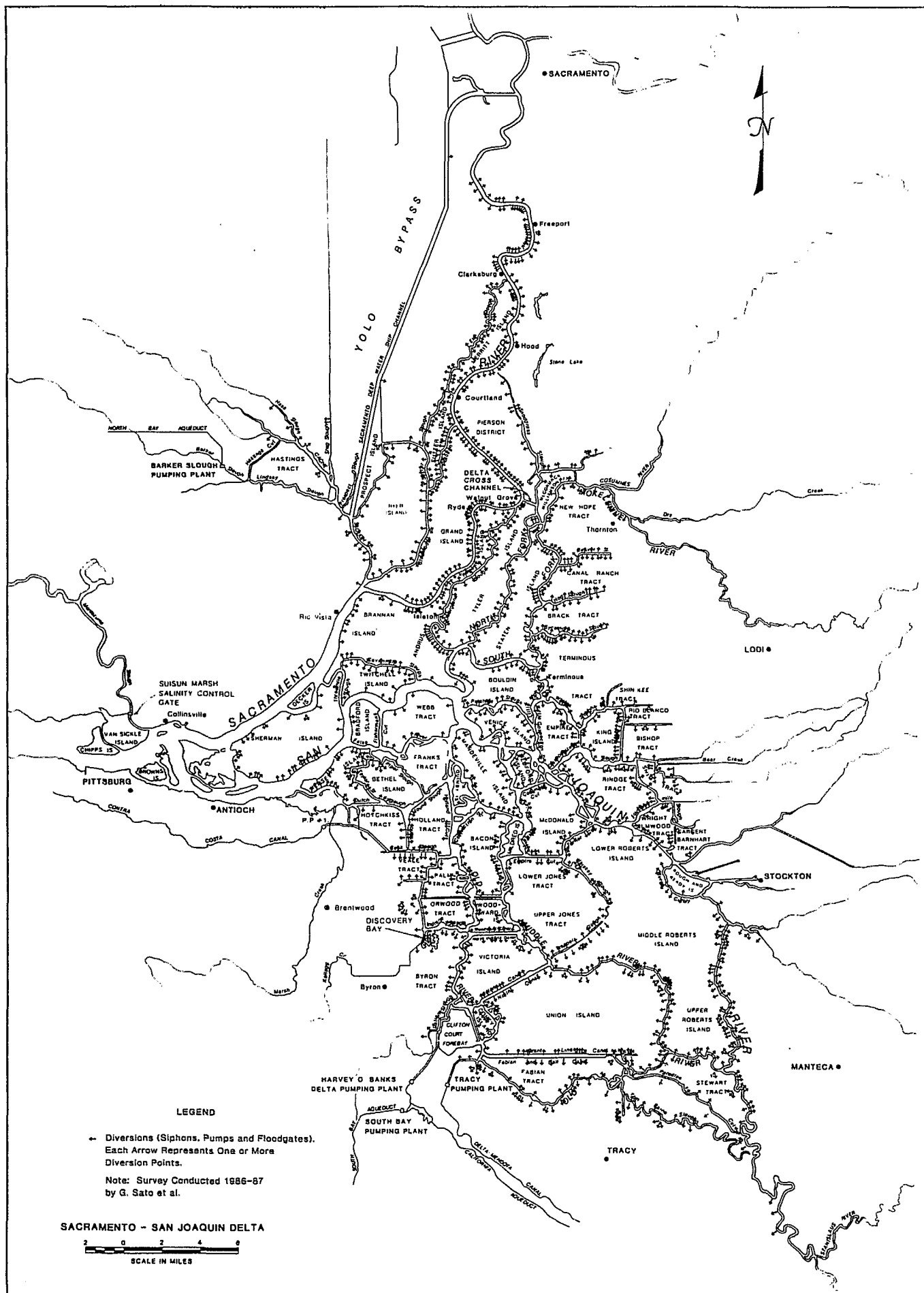


Figure 4. Water Development Facilities



Source: Department of Water Resources, Sacramento-San Joaquin Delta Atlas, 1993

Figure 5. Irrigation Facilities



Source: Department of Water Resources, Sacramento-San Joaquin Delta Atlas, 1993

## V. PLANTS AND ANIMALS

### A. Plants

The base of all ecosystem food chains consists of primary producers, the green plants which capture the sun's energy in photosynthesis and convert it to biomass. In Delta waterways, the chief primary producers are phytoplankton, primarily diatoms. The dominant forms include *Cyclotella*, *Melosira*, *Coscinodiscus*, and *Skeletonema* (Siegfried et al., 1978; Sitts and Knight, 1979). Green algae comprise a lesser fraction of the community. Blue-green algae dominate in the eastern Delta during the fall (Madrone, 1980). Availability of nutrients (especially inorganic nitrogen), water temperatures, and light levels appear to be the primary factors regulating phytoplankton abundance. Spring and summer phytoplankton population "peaks" result in such a large production of oxygen that dissolved oxygen concentrations can reach 200 percent of saturation. Conversely, in the fall, declining and decaying phytoplankton populations contribute to the dissolved oxygen deficits of 10 to 30 percent below saturation levels (Stevens and Chadwick, 1979). These oxygen levels may be below those required to sustain fish life, particularly in backwater sloughs and/or areas with reduced water circulation.

Common riparian woody species include willows (*Salix* spp.), cottonwoods (*Populus fremontii*), oaks (*Quercus* spp.), white alder (*Alnus rhombifolia*), and sycamores (*Platanus racemosa*). Blackberries (*Rubus* spp.), willows, elderberry (*Sambucus mexicana*), dogwood (*Cornus sericea*), and wild rose (*Rosa californica*) are common shrubs. Because of the dense and diverse canopy structure, and abundant leaf and invertebrate biomass production, riparian habitat is used by more vertebrate wildlife species (over 100) than any other Delta habitat type (Madrone, 1980). Species diversity and numbers of resident and migratory birds are especially high in Central Valley riparian habitats (Gaines, 1977). In addition, woody roots and branches overhanging or extending into the water make up a special type of habitat called "shaded riverine aquatic cover." This habitat is especially important to many fish species (DeHaven, 1989).

Delta agricultural fields occupy most of the land area in the Delta and are important producers of biomass, not only for obvious commodity values, but for wildlife as well. Wheat, corn and other grain crops provide foraging habitat for a large number of waterfowl and shorebirds. Most of the crop is harvested in summer and fall; a small percentage is left standing to attract wildlife. Orchards and vineyards are more permanent, are less intensively worked than crops such as asparagus and tomatoes, and provide cover for a number of bird species.

Ruderal (weedy) species are opportunistic plants that are characterized by rapid growth, short life cycles, and high rates of reproduction. Some of the more abundant "weedy" species in the Delta are radish (*Raphanus sativus*), mustard (*Brassica rapa*, *Hirschfeldia incana*), vetch (*Vicia villosa*), milk thistle (*Silybum marianum*), filaree (*Erodium* spp.), oat (*Avena* spp.),

ripgut grass (*Bromus diandrus*), and barley (*Hordeum murinum*). Ecologically, "weedy" species have a reproductive strategy that is favored by unstable environments. The Delta is home to a large number of "weedy" species due to disturbances such as levee maintenance and conversion of wetlands to agriculture. Native wetland species now must compete with introduced species for space within the Delta system. This competition is compounded with continued disturbance from human activities. Where levee banks are frequently and seriously disturbed, woody vegetation does not have the opportunity to become established, and "weedy" plants predominate.

The aquatic plants of the Delta can be categorized into four separate types based on their habit of growth. These include floating unattached, floating attached, submersed, and emergent. For the most part, these plants are restricted to the channels with slow currents, and may grow densely in shallow eddies and coves along the channel banks.

Emergent aquatic plants include tules (*Scirpus* spp.), reeds (*Phragmites* spp.), and cattails (*Typha* spp.), rush (*Juncus* spp.), spikerush (*Eleocharis* spp.), arrowhead (*Sagittaria* spp.), and smartweed (*Polygonum* spp.). These plants usually have their roots and basal portions submerged in shallow water and their leaves and stems above the water. These plants are often considered terrestrial vegetation, depending on the type of plant and the tidal or flow conditions. These plants dominate in the freshwater tidal marsh and often grow up to 15 feet tall. Marsh colonization typically begins in the slowest moving water. Sand or silt is deposited, and when the sediment reaches about one meter below the water surface, seedlings of California tule (*Scirpus californicus*) and common reed (*Phragmites australis*) develop as a thin stand of plants (Mason, 1972). As time passes, muck accumulates, common tule (*Scirpus acutus* var. *occidentalis*) becomes established among the pioneer species, forming a dense stand.

Common submersed plants in Delta waterways include water milfoil (*Myriophyllum* spp.), elodea (*Elodea canadensis*), pondweed (*Potamogeton* spp.), and coontail (*Ceratophyllum demersum*). These plants are restricted to the channels with slow currents, and may grow densely in shallow eddies and covers along channel banks. These plants spend their entire life cycle, with the possible exception of flowering, beneath the surface of the water. With very few exceptions, they are anchored to the bottom, and the vegetative portion of the plant does not reach the surface or else the terminal end lies in a horizontal position just beneath the surface.

Water hyacinth (*Eichhornia crassipes*) is an introduced plant from tropical America. Due to its rapid growth and reproductive rates, the plant is often a nuisance, often clogging waterways and at times blocking navigation. It floats about one foot out of the water and grows profusely during the summer and fall, particularly in the south Delta. Local water districts, as well as the California Department of Boating and Waterways, apply herbicides to the plants to control infestations. Water hyacinth is widely distributed throughout the Delta.

Duckweed (*Lemna* spp.), a tiny plant which also floats on the surface of the water, is usually

found in the slowest moving waters. Duckweed is typically found in ditches and ponds.

Floating, attached plants are uncommon in the Delta. These plants have leaves floating at the water surface and their roots anchored to the bottom. Yellow waterweed (*Ludwigia peploides*) and some pondweeds (*Potamogeton* spp.) are typical plants of this group. These plants are mainly restricted to backwater eddies and lagoons.

An inventory of the plants known to occur in the legal Delta, along with their habitat characteristics, relative abundance, and legal status (if any), is shown in Appendix B. This list was compiled from a variety of sources, mainly the habitat assessments completed by Kjeldsen and Arnold (1993). Additional plants were identified in Madrone (1980), (1992), Baba (1994), Ecos, Inc. (1990), and by Redpath (1992). The general policy was not to include cultivated plants or waifs (strays).

A total of over 400 species of plants are included in Appendix C, 8 of which are Special Status. Plants not native to California are denoted by an asterisk. This list probably does not include all of the species in the Delta, since new species are being discovered on a regular basis. Many of these plants have been identified by consulting botanists for levee reclamation districts, as well as by SB 34 personnel. About 54 percent of the species currently known to live in the Delta are native to California. However, in terms of area covered, non-native plants dominate much of the Delta. An unknown number of plant species are native to California but not to the Delta. Records of the early Delta are insufficient to establish a comprehensive list of species which were present historically.

## **B. Animals**

A diverse and abundant animal community is dependent upon the Delta's primary production, ranging from microscopic zooplankton and mud-dwelling clams and worms, to large fish, birds, and mammals.

The Delta vertebrate wildlife fauna is diverse, including over 300 native and introduced species. About 40 species have special status, with 9 designated as State or Federal Threatened or Endangered species. A list of the wildlife species for the Delta can be found in Appendix C.

### **1. Birds**

The varied habitats of the Delta support a wide variety of bird species. For 225 species of resident and migratory birds, the Delta provides a habitat critical for their survival.

#### **a. Waterfowl**

The Delta provides the most important wintering habitat for all species of waterfowl in the Pacific flyway (USFWS, 1978). This area is the second most important wintering area for

tundra swans (*Cygnus columbianus*) in the entire continent, second only to Chesapeake Bay (Bellrose, 1980). From 30,000 to 38,000 swans winter in the Delta, representing 32 to 40 percent of the Pacific Flyway population.

Reclamation of this area as sanctioned by Federal and State government created fertile farmland. However, while doing so, it also destroyed the extensive marshland habitat that was of great value to many birds. Flooded agricultural fields duplicate to some extent the functional values of the marshes and seasonally flooded backswamps of the pre-reclamation Delta. Thus, the habitat that currently exists continues to be of importance.

In the past, the Delta was a major nesting area for dabbling ducks, species which prefer to feed in shallow waters on aquatic vegetation and invertebrates. It also was one of the most significant areas for wintering migratory waterfowl, including ducks, geese and swans (USFWS, 1978). Today, the Delta supports very little waterfowl nesting, with 95 percent of the historic marsh converted to agriculture. However, the agricultural lands which replaced the marshes are very important for wintering waterfowl.

The hundreds of thousands of acres in agricultural fields are particularly valuable for geese and swans, which feed mainly by grazing upland areas. The Delta is especially important white-fronted geese (*Anser albifrons*), and "white" geese, which include Ross' geese (*Chen rossii*) and snow geese (*Chen caerulescens*). Between 22,000 and 45,000 white-fronted geese winter there, about one-third of the Pacific Flyway population.

Canada geese (*Branta canadensis*) are common in the Delta from November through March. The Aleutian Canada goose, a State and Federal Endangered species, uses the Delta as a stopover on the way to its main wintering ground in the San Joaquin Valley (Madrone, 1980). However, small numbers may overwinter in the Delta (Woolington et al., 1979, Herbold and Moyle, 1989).

Northern pintail ducks are the most abundant wintering duck species in the Delta. Numbers in the Delta represent 10 percent of the Central Valley and 7.5 percent of the Pacific Flyway Pintail populations. Pintails concentrate on flooded agricultural fields and also move between other areas in the Central Valley and Suisun Marsh. Mallards (*Anas platyrhynchos*) are the second most abundant duck species in the Delta, but are far less abundant than pintails (Herbold and Moyle, 1989).

Currently, cultivated areas provide most of the food available to migratory waterfowl. In addition, Ducks Unlimited and private property owners cooperate by seasonally flooding over 15,000 acres of croplands, creating additional habitat for geese, swans, as well as wintering shorebirds, and sandhill cranes (*Grus canadensis*).

#### **b. Other Birds**

Various species of shorebirds are found in the Delta. These include plovers, stilts, avocets,

sandpipers (includes curlews, snipe, and dowitchers), and phalaropes. Killdeer (*Charadrius vociferus*), black-necked stilt (*Himantopus mexicanus*), and American avocet (*Recurvirostra americana*) are among the more common species that nest in the Delta. Most of the others breed in the tundra, taiga, prairie, or Great Basin regions of North America. These species use the Delta as a migratory staging area or wintering grounds. Large concentrations of shorebirds can occur in the Delta during late summer through early spring where they often use shallowly flooded fields and tidal mudflats. These areas provide feeding habitat for several species during the rainy season including the black-bellied plover (*Pluvialis squatarola*), killdeer, greater yellowlegs (*Tringa melanoleuca*), long-billed curlew (*Numenius americanus*), least sandpiper (*Calidris minutilla*), dunlin (*Calidris alpina*), and common snipe (*Gallinago gallinago*).

Pastureland and open fields in the eastern Delta provide wintering habitat for thousands of greater and lesser sandhill cranes. The greater sandhill crane (*Grus canadensis tabida*) is currently designated as a Threatened species by the DFG (Appendix E). One of the most significant roosting areas within the Delta for populations of both greater and lesser sandhill cranes (*Grus canadensis canadensis*) is near Thornton, in particular Brack Tract and Staten Island. Optimal roosting sites are characterized by shallow flooded fields from 5 to 20 acres in size, typically interspersed with or surrounded by low herbaceous or emergent vegetation (USFWS, 1978). Feeding primarily occurs in harvested cornfields and nearby pastures. In recent years, an estimated two-thirds of the Central Valley population used the Delta during mid-winter (Pogson, 1990).

Rails of the Delta include the Virginia rail (*Rallus limicola*), sora (*Porzana carolina*), and California black rail (*Laterallus jamaicensis coturniculus*). The closely related American coot (*Fulica americana*) is also very common in the Delta. Rails are secretive by nature and nest and forage in marsh vegetation. The California black rail, more commonly associated with San Francisco Bay wetlands, is listed as Threatened by the DFG and a Category 1 Candidate species by the USFWS (Appendix E). A small number of black rails have been recorded in the freshwater marshes around White Slough and Middle River.

Colonial waterbirds and seabirds occur in a variety of Delta habitats and comprise several families. These include the double-crested cormorant (*Phalacrocorax auritus*), herons (*Ardea*, *Butorides*, and *Nycticorax* spp.), egrets (*Casmerodius* and *Egretta* spp.), gulls, and terns. Some of these birds, such as the double-crested cormorant (*Phalacrocorax auritus*), white-faced ibis (*Plegadis chihi*), American white pelican (*Pelecanus erythrorhynchos*), and California gull (*Larus californicus*), are California Species of Special Concern due to the fact that they nest in colonies. These colonies can be subject to human disturbance. Of these species, however, only the double-crested cormorant is known to nest in the Delta. The cormorant is a good example of an indigenous species that has successfully adapted to human disturbance. Some cormorants still nest on trees in some areas such as at Stone Lake, but most now nest on artificial structures such as bridges and towers. Herons and egrets generally nest on isolated islands, in shrubs or trees, which are relatively free of human disturbance and predators. Most of the gulls and terns found in the Delta commonly nest on

salt-pond levees in the Bay Area.

The higher elevation agricultural lands are important to many species of raptors (birds of prey). Raptors such as hawks, falcons, and owls generally nest within the larger trees of riparian and grassland habitats and feed on small animals that also inhabit the area. A few raptors such as the northern harrier (*Circus cyaneus*) and short-eared owl (*Asio flammeus*), nest on the ground. Some of the most commonly observed raptors in the Delta include the red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), turkey vulture (*Cathartes aura*), northern harrier, barn owl (*Tyto alba*), white-tailed kite (*Elanus caeruleus*), and American kestrel (*Falco sparverius*).

The Swainson's hawk, a State Threatened raptor species, breeds in the Delta (Appendix E). Preferred habitat consists of tall trees (e.g., oaks) for nesting and perching with proximity to open fields and grasslands which support small rodents for prey. The Swainson's hawk is locally common in summer in portions of the northern and eastern peripheries of the Delta. The highest breeding density of Swainson's hawks in the Central Valley is found in the region between Sacramento and Stockton, which includes portions of the eastern Delta (Estep, 1989).

The northern harrier, a California Species of Special Concern, is a common year-round resident and, to a lesser extent, winter visitor in the marshes and grasslands of the Delta.

The burrowing owl (*Athene cunicularia*), also a California Species of Special Concern, is an uncommon year-round resident. It nests in abandoned burrows of ground squirrels and other small mammals.

Belted kingfishers (*Ceryle alcyon*) are seen and heard along banks in a variety of habitats, but always are associated with channels, lakes, or drainage ditches where they feed mainly on fish. Swallows (*Hirundo pyrrhonota* and *H. rustica*, *Tachycineta bicolor* and *T. thalassina*, and *Stelgidopteryx serripennis*) use a variety of habitats as well, but nest near and feed extensively on insects over water. Northern flickers (*Colaptes auratus*) and Nuttall's woodpeckers (*Picoides nuttallii*), while not common in the Delta, can generally be found in areas containing larger trees. They nest in holes that they excavate in trees and feed on insects in riparian forests and planted ornamentals.

Passerine or song birds are found in a variety of habitats. Many, such as the scrub jay (*Aphelocoma coerulescens*), song sparrow (*Melospiza melodia*), white-crowned sparrow (*Zonotrichia leucophrys*), common yellowthroat (*Geothlypis trichas*), and rufous-sided towhee (*Pipilo erythrophthalmus*), use the shrub, woodland, or marsh habitats. Western meadowlarks (*Sturnella neglecta*), American goldfinch (*Carduelis tristis*), and American crow (*Corvus corax*) are found in grassland and agricultural areas. The Brewer's blackbird (*Euphagus cyanocephalus*) and red-winged blackbird (*Agelaius phoeniceus*) are often abundant in both flooded and unflooded agricultural fields. The tricolored blackbird (*Agelaius tricolor*), a California Species of Special Concern and Federal Category 2



Candidate species, can be a fairly common visitor to the Delta during the nonbreeding season (Appendix E).

The upland (game) species found in the Delta are usually associated with valley grassland and agricultural habitats. These species include the introduced ring-necked pheasant (*Phasianus colchicus*) and native California quail (*Callipepla californica*) and mourning dove (*Zenaida macroura*). Thousands of these game species are taken in the Delta each year by hunters.

Neotropical migrants are birds which migrate from temperate to tropical climates for the winter. They are mainly songbirds, but also include some raptors like the Swainson's hawk. Examples of neotropical migrant species in the Delta include the western kingbird (*Tyrannus verticalis*), yellow warbler (*Dendroica petechia*), blue grosbeak (*Guiraca caerulea*), Swainson's hawk, and the western wood pewee (*Contopus sordidulus*). These species are usually found in riparian forest areas throughout the Delta. Populations of most of these migrants are declining from habitat losses in both temperate and tropical zones.

## 2. Mammals

Fifty-two mammal species are in the Sacramento-San Joaquin Delta (COE, 1979). Others from neighboring areas can be expected as rarities (Appendix C). The once abundant and diverse mammalian fauna in the Delta is now dominated by species which can tolerate proximity to human populations, such as the striped skunk (*Mephitis mephitis*), common opossum (*Didelphis marsupialis*), California ground squirrel (*Spermophilus beecheyi*), beaver (*Castor canadensis*), and muskrat (*Ondatra zibethicus*).

About 25 percent of the mammals found in the Delta depend on riparian or wetland habitats (Appendix C). They either occur only in this habitat or are rare in other habitats.

The salt marsh harvest mouse (*Reithrodontomys raviventris*) is a State-and Federally-listed Endangered species. It and the Suisun shrew (*Sorex sinuosus*) are found only in tidal marsh habitat or, possibly, on some of the managed wetlands of Delta duck clubs (Appendix E). Beavers, muskrats, mink (*Mustela vison*), and river otters (*Lutra canadensis*) are aquatic, requiring permanent water. Opossums and raccoons (*Procyon lotor*) use riparian habitats for cover, den sites, and feeding, but also feed in adjacent habitats. Towbridge, vagrant, and ornate shrews and shrew moles (*Sorex towbridgii*, *S. vagrans*, *S. ornatus*, and *Neurotrichus gibbsii*) require the moist microhabitats associated with riparian and wetland habitats. Most predators, such as coyotes (*Canis latrans*) and skunks frequent riparian zones for foraging and cover.

Mammalian herbivores are of major importance in wetland and riparian habitat. Beavers and muskrats are particularly important because of their size and abundance.

Beavers are common throughout the Delta. They prefer water with slow-to-moderate flows

and need access to appropriate foods. They have been described as "choosy generalists" (Jenkins and Busher, 1979). This is because they eat various foods depending on availability, but have definite preferences among the available plant species. They eat a variety of aquatic and woody riparian plants, the latter primarily in winter (Jenkins and Busher, 1979; Hill, 1982). In the Delta, beavers eat roots, bulbs, grasses, cattails, tules, and the bark and twigs of woody riparian plants (Grinnell et al., 1937; Tappe, 1942). Among the woody plants, beavers prefer (in decreasing order) are: willow, cottonwood, and alder. Grinnell et al., (1937) found that cattail stalks and willow bark were the most common foods in fall and winter.

Beaver denning habits depend on habitat type. They either build nests of vegetation or dig burrows in banks. In large lowland waterways such as the Delta, flows are extremely variable, and beavers reside in burrows rather than constructing lodges and dams. Tappe (1942) suggested that levee construction habitat allowed beavers to become more abundant in areas subject to inundation. Interviews with trappers (Tappe, 1942) suggested that beavers are more transient in Delta habitats than in other places. This may be related to the distribution of suitable habitat or the lack of dam and lodge construction.

Beavers and ground squirrels which burrow into Delta levees are considered serious threats to levee stability by maintenance authorities (Herbold and Moyle, 1989). Burrows in levees can weaken the levee section and contribute to levee failure by increasing the potential for seepage.

Muskrats are herbivores which feed on a variety of aquatic and terrestrial plants. They are found in most aquatic habitats, including marshes, ponds, lakes, riparian communities, and ditches (Wilner et al., 1980; Perry, 1982). They use burrows in banks, and if sufficient emergent aquatic vegetation is present, they build nests and feeding platforms of floating vegetation. Like those of the beaver, the entrances of muskrat burrows may be below water level, making detection of burrow systems difficult. Muskrat feeding and nesting create openings in wetland vegetation which have been shown to attract other wildlife species, including waterfowl (Weller and Frederickson, 1974; Weller, 1981). Muskrats may attain high population densities, and during these times, harvesting of food plants and nesting material may remove a significant fraction of the plant biomass. These "eat-outs" (Lynch et al., 1947; Weller, 1981; Perry, 1982) may not recover for several years. Such dramatic effects on vegetation structure do not occur in the Delta, perhaps because much of the habitat used by muskrats is discontinuous.

Muskrats affect the physical environment by their burrowing and foraging activities. They dig extensively for roots and rhizomes of aquatic plants. While digging for these foods, muskrats disturb marsh soils and remove plant structures that stabilize such soils. Extensive digging, which can occur during population highs, can result in significant erosion loss of marsh soils (Wilner et al., 1980).

Mink (*Mustela vison*) and river otters (*Lutra canadensis*) are aquatic carnivores, and are

opportunistic in their prey choices. River otters prey on fish, shellfish, and sometimes small mammals and birds. In one study, river otters ate crayfish at all times of the year, with 95 percent of scats in each month containing crayfish (Grenfell, 1978). During the fall and winter, waterfowl became important and were found in 38 percent of scats. Fish remains were found in 30 percent of otter scats and were most frequent in winter and spring. There was no evidence of egg predation during waterfowl nesting. One of the most concentrated river otter populations in the State is just west of the Delta in Suisun Marsh. Mink eat a variety of foods, including crayfish and other invertebrates, fish, frogs, small mammals, and birds.

Mammal species inhabiting riparian woodland habitats is diverse as well. Bats (*Myotis yumanensis*, *M. evotis*, *M. californicus*, *Pipistrellus hesperus*, *Eptesicus fuscus*, *Lasiurus borealis*, and *L. cinereus*) feed on insects, while omnivores such as raccoons, opossums, striped skunks, and gray squirrels (*Sciurus griseus*) forage and find cover in woodlands. Black rats (*Rattus rattus*) and house mice (*Mus musculus*), both introduced species, are abundant in this type of habitat.

Ruderal and agricultural lands are often populated with house mice, California voles (*Microtus californicus*), pocket gophers (*Thomomys bottae*), California ground squirrels (*Spermophilus beecheyi*), and Norway rats (*Rattus norvegicus*). Black-tailed hares feed in the area, as do various predators and scavengers, including the grey fox (*Urocyon cinereoargenteus*), coyote, raccoon, skunk, and occasional weasel (*Mustela frenata*).

Omnivores such as raccoons, opossums, and striped skunks, are common. A wide variety of plant and animal matter, including berries, fruits, insects, small mammals, birds, and carrion are foods for these species. Skunks have been reported as important predators on shoveler and mallard nests (Bellrose, 1980). About 20 percent of cinnamon teal (*Anas cyanoptera*) nests in one California study were destroyed, probably by mammalian predators.

### 3. Reptiles and Amphibians

Most Delta amphibians (Appendix C) occur predominantly in marsh, riparian, and small pond and pool habitats. Only the California slender salamander (*Batrachoseps attenuatus*) and the arboreal salamander (*Aneides lugubris*) occur in upland habitats (USFWS, 1989).

Loss of wetlands to agriculture has reduced native amphibian populations such as the California red-legged frog (*Rana aurora draytonii*) and California tiger salamander (*Ambystoma californiense*). Both are California Species of Special Concern and Federal Candidate species. The California red-legged frog was formerly very abundant in the Delta. In addition to wetland losses, massive hunting efforts to supply San Francisco restaurants with frog legs in the late 1800s significantly reduced populations of this native red-legged frog. Predation by introduced fishes probably reduced populations as well (Moyle, 1973).

Bullfrogs (*Rana catesbeiana*), an introduced species from the eastern United States, are now

abundant and widely distributed in the Delta. Highly aquatic, bullfrogs are found in ponds, irrigation ditches, marshes, and sloughs, and other permanent waters. They enter hibernation as late as November and emerge as early as February (Treanor, 1983). The bullfrog is the largest frog in California, and it may prey on, or compete for food and space with, native amphibians with which it lives.

Reptiles of the Delta (Appendix C) are somewhat restricted to upland or agricultural habitats. The Pacific gopher snake (*Pituophis melanoleucus*) and western fence lizard (*Sceloporus occidentalis*) are the most widespread reptiles in the Delta. The only common aquatic reptile is the western pond turtle (*Clemmys marmorata*), a California Species of Special Concern and a Federal Category 2 Candidate species (Appendix E). The giant garter snake (*Thamnophis gigas*), a State and Federally-listed Threatened species, may occasionally be found along grassy sloughs, ditches, and ponds in the eastern periphery of the Delta (Appendix E).

There are no successfully introduced reptiles species in the Delta. Occasional red-eared slider turtles (*Chrysemys picta*), lost from pet owners, are seen in the Delta.

#### 4. Fish

The Delta supports a total of 26 native fish species (Herbold and Moyle, 1989) (Appendix D). Some are anadromous (living at sea, breeding in fresh water) and others spend their entire lives in the Delta. Common resident species include the Sacramento sucker (*Catostomus occidentalis*), tule perch (*Hysterocarpus traski*), and the Sacramento squawfish (*Ptychocheilus grandis*). Native anadromous species include steelhead, four separate runs of chinook salmon (*Oncorhynchus tshawytscha*), and two species of sturgeon (*Acipenser transmontanus* and *medirostris*).

All Central Valley salmon and steelhead trout migrate through the Delta on their way to upstream spawning beds (Reynolds, et al., 1990). The Delta is also important to young salmon and steelhead going to the ocean. Salmon may spend a month or more rearing in Delta channels. Fish able to make the transition into salt water, called smolts, run through the Delta in one to two weeks (USFWS, 1987b). Juvenile salmon can be found in the Delta during all months of the year.

There are 28 non-native species of fish found in the Delta (Herbold and Moyle, 1989) (Appendix D). In fact, the most abundant species found here are introduced species: threadfin shad (*Dorosoma petenense*), carp (*Cyprinus carpio*), white catfish (*Ictalurus catus*), inland silversides (*Menidia beryllina*), largemouth bass (*Micropterus salmoides*), and striped bass (Herbold and Moyle, 1989). American shad were introduced in 1871. Striped bass were introduced between 1879 and 1882. Both species established themselves quickly after introduction and supported large commercial fisheries. Commercial fishing for these species has now been banned, but they still support sport fisheries.

Striped bass have become an important sport species in the Delta. Most stripers spawn in

the Sacramento River upstream of the Delta. Young fish may rear for up to three years in the Delta. Adult striped bass populations have dropped from 1.5 - 2.0 million fish in the early 1970's to less than 1 million today. Overall, striped bass populations are about one-third the size of former levels.

Appendix E includes a discussion of fish species with Special Status. These include the Delta smelt, winter-run chinook salmon, and Sacramento splittail (*Pogonichthys macrolepidotus*). All have experienced large declines, which have been documented to be caused, at least in part, by habitat modifications.

Habitat losses for other species have not been as well documented. The starry flounder (*Platichthys stellatus*) can live in fresh, brackish, or salt water, but requires fresh or brackish water for spawning. This species was plentiful in San Francisco Bay and the Delta throughout the 1970s, but have declined since then due to unknown causes (Heib, pers. comm.).

Other species that were once abundant in the Delta, but are now very reduced in numbers, include the Sacramento perch (*Archoplites interruptus*) and longfin smelt (*Spirinchus thaleichthys*). These are both California Species of Special Concern. The Sacramento perch is California's only native sunfish and may be extirpated from the Delta region. Longfin smelt were once one of the most abundant fish caught by various trawl surveys. Since 1983, their numbers have been reduced and have remained at record low numbers. Many factors have contributed to the decline of both the Sacramento perch and longfin smelt. These include domestic and agricultural pollution, entrainment in water diversions, loss of spawning habitat, and predation from introduced predatory fish.

Perhaps no other group of species in the Delta reflects the degree to which the ecosystem has been modified by modern humans better than the fish fauna. Water diversions, mainly in the form of freshwater exports from the Delta have had significant adverse impacts on the environment. They are believed to be the most significant adverse impact on Delta fish populations. Delta water diversions include the following:

- a. SWP
- b. CVP
- c. Contra Costa Canal
- d. Unscreened Delta Agricultural Diversions — The estimated 1,800 diversions cumulatively pump about as much water as the combined State and Federal Water Projects (Bay Delta Accord, 1994)
- e. PG & E diversions — There are two diversions; at Pittsburg and at Antioch

f. Delta Cross Channel and Georgiana Slough

Impacts to fish populations have also resulted from poaching, introduction of exotic fish species, water quality degradation, and other factors.

The SWP and CVP divert an average of 50 percent of Delta outflow (SLC, 1991). These and agricultural intakes result in significant fisheries losses, from juvenile salmon and young stripers to chameleon gobies (*Tridentiger trigoncephalus*) and Delta smelt.

One of the main indices of fish abundance over time is the abundance of fish salvaged at Clifton Court Forebay. During 1991, a total of 158,119 fish were caught at all sites. The most abundant larval fish species was the chameleon goby.

The diversity of species and numbers of fish salvaged at the SWP and CVP facilities indicate the magnitude of the impacts of these facilities on fish populations. Numbers of fish salvaged at the pumps, corrected for diversion rates, may also provide an indication of the change in total population of individual species over time. The results of the fish salvage tallies have been graphed in various IEP reports have shown that there has been a large decrease in the number of fishes of various species which have been salvaged at each facility. These include Sacramento blackfish (*Orthodon microlepidotus*) and hardhead (*Mylopharodon conocephalus*), both native minnows.

Reverse flows in many Delta channels affect migratory species such as salmon and steelhead as well. This is due to the SWP and CVP pumping. These flows confuse adult salmonids migrating upstream, resulting in delayed passage or improper home selection (Reynolds, 1990).

There have been other reasons for reductions in fish populations in the Delta. These include water quality problems (including the adverse impacts of pesticides and agricultural outflow), the effects of introduced fish species on native fish species, and losses of habitat. Fish habitat losses have occurred as a result of dredging, removal of vegetation along levees, channelization, and other factors.

A comprehensive, electrofishing survey of the Delta was conducted from 1980 to 1983 by the DFG Bay Delta Division (DFG, 1987). White catfish were the most abundant species found in the survey, particularly in the southern Delta. The eastern Delta supported the highest total number of species and species diversity, while the western Delta was the lowest, both in total numbers and diversity. There was also a difference between those species found in transport channels and elsewhere. Transport channels flows are reversed from the natural flow pattern. They are used for transport of water to the SWP and CVP pumps. White catfish, tule perch, Sacramento blackfish, and Sacramento suckers were more abundant in non-transport channels.

There are various structures present throughout the Delta which provide fish habitat. These

include shallow water shoals, tule marshes, shaded riverine aquatic (SRA) habitat, and riprap. These habitats provides fish spawning and nursery areas, protection from predators, and attract forage species.

## 5. Invertebrates

Largely unseen and unnoticed, invertebrate animals nonetheless are important as food for many of the major fish and wildlife in the Delta. Although over 80 species of benthic invertebrates have been noted in the Delta, only five species dominate, including the introduced Asiatic clam (*Corbicula* spp).

The major zooplankton of importance as food for Delta fish are the copepod (*Eurytemora* spp.) and the opossum shrimp, (*Neomysis mercedis*) (Herbold and Moyle, 1989). Zooplankton populations in the open water channels of the Delta are an important component of the aquatic food web, serving as the major food source for young fish. Copepods dominate the zooplankton community throughout the year. The dominant species of copepods include cyclopoid, calanoid, and harpacticoid copepods. Less abundant members of the zooplankton community include molluscan larvae, dcapod crustacean larvae, and larval fish. Zooplankton abundance usually peaks in late winter or early spring, generally remains high throughout the summer and finally declines in the fall (Siegfried et al., 1978; Sitts and Knight, 1979).

The opossum shrimp is eaten by almost all species of fish found in the Delta and is especially important as forage for striped bass less than one year old. Opossum shrimp populations generally increase in abundance in the spring, peak between late spring and late summer, then rapidly decline in the fall and winter. The center of maximum abundance coincides with the location of the entrapment zone (see Water Systems). The abundance varies annually with Delta outflow. During low flow years, the population is smaller and restricted to narrow channels of the Delta (Siegfried et al., 1978, 1979; Orsi and Knutson, 1979).

Two shrimp are abundant in the downstream, more saline waters of the Delta: the native bay shrimp (*Crangon franciscorum*) and the introduced grass shrimp (*Palaemon macrodactylus*). Both of these shrimp are prey for several fish species. The bay shrimp, a native species, supports a commercial bait fishery centered in Suisun and San Francisco bays. It is generally most abundant in the Delta during the spring and summer.

Grass shrimp were accidentally introduced into the San Francisco Bay Estuary during the 1950s by ships returning from the Orient (Smith and Carlton, 1975). The grass shrimp has habits similar to those of the bay shrimp, rising in the water column at night and feeding primarily on the opossum shrimp. The similarities suggest that competitive interactions may be significant. The grass shrimp appears to be more successful in brackish and fresh water than the bay shrimp, which dominates in more saline areas (Carlton, 1979). Grass shrimp can reproduce in freshwater, unlike the bay shrimp which requires saline waters. This may

give it a competitive advantage in the Delta region (Siegfried et al., 1978).

Some shrimp species are confined to vernal pools like those found at Olcott Lake at Jepson Prairie Preserve near Dixon. Four species of freshwater shrimp were recently listed by the USFWS. Three of these could occur in the Delta: the Conservancy fairy shrimp (*Branchinecta conservatio*), vernal pool fairy shrimp (*Branchinecta lynchi*), and vernal pool tadpole shrimp (*Lepidurus packardii*). None are known to occur in riverine waters, marine waters, or any other permanent bodies of water. They are ecologically dependent on seasonal absence or presence of water during certain times of the year and other environmental factors that include specific salinity, conductivity, dissolved solids, and Ph levels.

The benthic community of the Delta channels, ditches, tidal flats, and submerged islands and marshes is not particularly diverse. The dominant species include amphipods, unidentified oligochaete worms, mud crabs (*Rhithropanopeus harrisi*), clams and crayfish (*Procambarus* and *Pacifasticus* spp.) (Hazel and Kelley, 1966; Siegfried et al., 1978).

Two amphipod species dominate the benthos. *Corophium stimpsoni* are the most abundant benthic animals in the Delta, and are found throughout the entire Delta. *C. stimpsoni* is usually most abundant in broad tidal channels of the Delta, particularly in the San Joaquin River. Within channels, another amphipod (*C. spinicorne*) usually occurs along the banks between the low tide mark to 10 feet deep, while *C. stimpsoni* exhibits a preference for deeper waters. The two species do coexist, but where one species is abundant, the other is usually rare (Hazel and Kelley, 1966). Amphipods are eaten by a number of fish, including striped bass (Ganssle, 1966).

The mud crab was introduced into the San Francisco Estuary from the Atlantic coast, and has become established in the brackish and fresh waters of the Delta. It is occasionally important in the diet of white sturgeon (*Acipenser transmontanus*) and other bottom-feeding fish in the Delta (Carlton, 1979).

Most Delta mollusks are introduced. These include the gem clam (*Gemma gemma*), Japanese cockle (*Tapes japonica*), and the Asiatic clam (*Corbicula fluminea*). The Asiatic clam is abundant in many parts of the Delta, particularly on tule berms and nearshore areas, and is now the most widespread and abundant freshwater clam in the State (USFWS, 1989). The population density of the Asiatic clam is usually greatest in winter between January and March (Hazel and Kelley, 1966; Siegfried et al., 1978). The asiatic clam has become so abundant in the Delta that tons of them are dredged when the Delta-Mendota Canal is drained for repairs. The Japanese cockle and gem clam are eaten by bottom-feeding fish, such as white sturgeon, by raccoons, and by some shorebirds (Carlton, 1979).

Potamocorbula clams, introduced from Asia, have been in Delta for years. However, this clam is restricted by salinities and will not tolerate fresh water concentrations below about 2 parts per thousand in the Delta. In late summer, or during drought years, its range extends



to about Chipps Island in the western Delta.

Two introduced species of crayfish are common in the Delta. They are sold commercially as bait and for human consumption, and are the basis of a small but popular sport fishery. The signal crayfish (*Pacifasticus leniusculus*) occurs in a variety of habitats in the Delta, ranging from swift channels to muddy sloughs. They were introduced to the Delta in 1898 and have, in recent years, yielded commercial harvests of 500,000 lbs./year (Herbold and Moyle, 1989). The red swamp crayfish (*Procambarus clarkii*) prefers warm vegetated sloughs (Riegel, 1959). In daylight crayfish stay beneath rocks and other debris, moving out to feed at night. Crayfish are important forage for bass and other fish, birds, turtles, and raccoons.

There are five species of mosquito in the Delta. The biggest problem associated with mosquitoes is their ability to carry and spread encephalitis. Winter flooding of agricultural areas has the potential for increasing mosquito production.

Three insects, the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), Delta green ground beetle (*Elaphrus viridis*), and Lange's metalmark butterfly (*Apodemia mormo langei*), are officially listed as rare or endangered by the USFWS. The Delta green ground beetle, currently designated as a Threatened species, is known only from the Nature's Conservancy's Jepson Prairie Preserve. This beetle mainly inhabits the borders of the vernal pools and Olcott Lake.

The Lange's metalmark butterfly, Federally-listed as an Endangered species, is found only at the Antioch Dunes, east of the city of Antioch. The larvae of this subspecies feed exclusively on a subspecies of naked buckwheat (*Eriogonum nudum* var. *auriculatum*). Adults emerge in late summer with a life span of about one week.

The valley elderberry longhorn beetle is listed as Threatened by the USFWS (Appendix E). This beetle is endemic to moist riparian woodlands in the lower Sacramento and San Joaquin valleys where its primary food and plant host, the elderberry plant, grows. The main threats to this species are the loss and alteration of habitat by agricultural conversion, grazing, levee construction, stream and river channelization, removal of riparian vegetation, shoreline riprapping, and urban, recreational and industrial development.

### C. Special Status Species

A number of species in the Delta have been designated as Special Status species by Federal and State governments, having sufficiently declined in numbers to deserve special protection or monitoring (Table 2). Most of these declines have resulted from habitat losses.

The term "Special Status" species is a "catch all" phrase and refers to species that are protected under the provisions of the Federal Endangered Species Act (ESA) and/or California Endangered Species Act (CESA) and/or meet the definition of a rare or endangered species under Section 15380 of CEQA. Included are species which have a State

or Federal classification of Rare, Candidate, Proposed, Threatened, or Endangered. Detailed discussions, including maps of known sightings, for those Special Status species most likely to occur within the general vicinity of SB 34 work areas have been included in Appendix E. Species solely designated as California Species of Special Concern are not included in this Appendix. This is due to the large number of these species. Also, Species of Special Concern are not necessarily CEQA defined rare or endangered species. However, CEQA still encourages that they receive consideration as dictated by their actual rarity or degree of endangerment.

Table 2. – Special Status Species Known or Potentially Known to Occur in the Sacramento-San Joaquin Delta.

	COMMON AND SCIENTIFIC NAME	STATUS	OCCURRENCE IN DELTA
PLANTS	*Suisun marsh aster <i>Aster lentus</i>	Fed-C2; CNPS-1B	Common
	Slough thistle <i>Cirsium crassicaule</i>	Fed-C2; CNPS-1B	Unknown
	Delta coyote thistle <i>Eryngium racemosum</i>	Ca-E; Fed-C2; CNPS-1B	Historic
	Contra Costa wallflower <i>Erysimum capitatum</i> var. <i>angustatum</i>	Ca-E; Fed-E; CNPS-1B	Antioch Dunes
	*California hibiscus <i>Hibiscus lasiocarpus</i>	CNPS-2	Common
	*Delta tule pea <i>Lathyrus jepsonii</i> var. <i>jepsonii</i>	Fed-C2; CNPS-1B	Common
	*Mason's lilaeopsis <i>Lilaeopsis masonii</i>	Ca-R; Fed-C2; CNPS-1B	Common
	Colusa grass <i>Neostapfia colusana</i>	Ca-E; Fed-P(T); CNPS-1B	Jepson Prairie Preserve
	*Antioch Dunes evening primrose <i>Oenothera deltoides</i> ssp. <i>howellii</i>	Ca-E; Fed-E; CNPS-1B	Antioch Dunes, Brannan Island
	*Sanford's arrowhead <i>Sagittaria sanfordii</i>	Fed-C2; CNPS-1B	Uncommon
	*Marsh skullcap <i>Scutellaria galericulata</i>	CNPS-2	Uncommon
	Blue skullcap <i>Scutellaria lateriflora</i>	CNPS-2	Probably extirpated
	Caper-fruited tropidocarpum <i>Tropidocarpum capparideum</i>	Fed-C2; CNPS-1A	Possibly extinct
	Solano grass <i>Tuctoria mucronata</i>	Ca-E; Fed-E; CNPS-1B	Jepson Prairie Preserve
BIRDS	Common loon (breeding) <i>Gavia immer</i>	Ca-CSC	Uncommon (winter)
	American white pelican (nesting colony) <i>Pelecanus erythrorhynchos</i>	Ca-CSC	Common (winter)
	Double-crested cormorant (rookery) <i>Phalacrocorax auritus</i>	Ca-CSC	Common
	Western least bittern <i>Ixobrychus exilis hesperis</i>	Ca-CSC; Fed-C2	Rare
	White-faced ibis (rookery) <i>Plegadis chihi</i>	Ca-CSC; Fed-C2	Occasional (non- breeding)
	*Aleutian Canada goose <i>Branta canadensis leucopareia</i>	Ca-CSC; Fed-T	Occasional (winter)
	Bald eagle <i>Haliaeetus leucocephalus</i>	Ca-E; Fed-E	Rare (winter)
	Northern harrier (nesting) <i>Circus cyaneus</i>	Ca-CSC	Common
	Sharp-shinned hawk (nesting) <i>Accipiter striatus</i>	Ca-CSC	Uncommon
	Cooper's hawk (nesting) <i>Accipiter cooperii</i>	Ca-CSC	Uncommon
	*Swainson's hawk (nesting) <i>Buteo swainsoni</i>	Ca-T; Fed-C3c	Common (summer)
	Ferruginous hawk (wintering) <i>Buteo regalis</i>	Ca-CSC; Fed-C2	Uncommon (winter)
	Golden eagle <i>Aquila chrysaetos</i>	Ca-CSC	Uncommon (winter)

Table 2. - Continued

	COMMON AND SCIENTIFIC NAME	STATUS	OCCURRENCE IN DELTA
	Merlin <i>Falco columbarius</i>	Ca-CSC	Uncommon (winter)
	Peregrine falcon (nesting) <i>Falco peregrinus anatum</i>	Ca-E; Fed-E	Uncommon (winter)
	Prairie falcon (nesting) <i>Falco mexicanus</i>	Ca-CSC	Uncommon (winter)
	*California black rail <i>Laterallus jamaicensis coturniculus</i>	Ca-T; Fed-C2	Occasional
	*Greater sandhill crane <i>Grus canadensis tabida</i>	Ca-T	Common (winter)
	Long-billed curlew (breeding) <i>Numenius americanus</i>	Ca-CSC	Occasional (winter)
	California gull (nesting colony) <i>Larus californicus</i>	Ca-CSC	Common (non-breeding)
	Black tern (nesting colony) <i>Chlidonias niger</i>	Ca-CSC; Fed-C2	Uncommon (non-breeding)
	Burrowing owl (burrow sites) <i>Athene cunicularia</i>	Ca-CSC	Uncommon
	Long-eared owl (nesting) <i>Asio otus</i>	Ca-CSC	Uncommon
	Short-eared owl (nesting) <i>Asio flammeus</i>	Ca-CSC	Uncommon
	Mountain plover (wintering) <i>Charadrius montanus</i>	Ca-CSC; Fed-C2	Rare (winter)
	Yellow warbler <i>Dendroica petechia</i>	Ca-CSC	Uncommon (summer)
	Suisun song sparrow <i>Melospiza melodia maxillaris</i>	Ca-CSC; Fed-C2	Suisun Marsh
	*Tricolored blackbird <i>Agelaius tricolor</i>	Ca-CSC; Fed-C2	Occasional
MAMMALS	Suisun shrew <i>Sorex ornatus sinuosus</i>	Ca-CSC; Fed-C1	Suisun Marsh
	Townsend's western big-eared bat <i>Plecotus townsendii</i>	Ca-CSC	Uncommon
	Pallid bat <i>Antrozous pallidus</i>	Ca-CSC	Uncommon
	Western mastiff bat <i>Eumops perotis</i>	Ca-CSC	Uncommon
	*Salt-marsh harvest mouse <i>Reithrodontomys raviventris</i>	Ca-E; Fed-E	Uncommon (western Delta)
	*San Joaquin kit fox <i>Vulpes macrotis mutica</i>	Ca-T; Fed-E	Rare (southern Delta)
	Badger <i>Taxidea taxus</i>	Ca-CSC	Uncommon
REPTILES/ AMPHIBIANS	California tiger salamander <i>Ambystoma californiense</i>	Ca-CSC; Fed-C2	Pools, Jepson Prairie Preserve
	California red-legged frog <i>Rana aurora draytonii</i>	Ca-CSC; Fed-C1	Probably extirpated
	Foothill yellow-legged frog <i>Rana boylei</i>	Ca-CSC; Fed-C2	Unlikely
	*Western pond turtle <i>Clemmys marmorata</i>	Ca-CSC; Fed-C2	Common
	*Giant garter snake <i>Thamnophis gigas</i>	Ca-T; Fed-T	Uncommon

Table 2. - Continued

	COMMON AND SCIENTIFIC NAME	STATUS	OCCURRENCE IN DELTA
INVERTEBRATES	Conservancy fairy shrimp <i>Branchinecta conservatio</i>	Fed-E	Vernal pools (Jepson Prairie Preserve)
	Vernal pool fairy shrimp <i>Branchinecta lynchi</i>	Fed-T	Vernal pools
	Vernal pool tadpole shrimp <i>Lepidurus packardii</i>	Fed-E	Vernal pools (Jepson Prairie Preserve)
	*Antioch Dunes anthicid beetle <i>Anthicus antiochensis</i>	Fed-C2	Uncommon (Sand dunes)
	*Sacramento anthicid beetle <i>Anthicus sacramento</i>	Fed-C2	Uncommon (Sand dunes)
	*Valley elderberry longhorn beetle <i>Desmocerus californicus dimorphus</i>	Fed-T	Occasional
	San Joaquin Dune beetle <i>Coelus gracilis</i>	Fed-C1	Antioch (possibly extirpated)
	Delta green ground beetle <i>Elaphrus viridis</i>	Fed-T	Jepson Prairie Preserve
	Lange's metalmark butterfly <i>Apodemia mormo langei</i>	Fed-E	Antioch Dunes
FISH	River lamprey <i>Lampetra ayresi</i>	Ca-CSC	Uncommon
	Pink salmon <i>Oncorhynchus gorbuscha</i>	Ca-CSC	Uncommon
	Chinook salmon (spring-run) <i>Oncorhynchus tshawytscha</i>	Ca-CSC	Occasional
	*Chinook salmon (winter-run) <i>Oncorhynchus tshawytscha</i>	Ca-E; Fed-E	Occasional
	*Delta smelt <i>Hypomesus transpacificus</i>	Ca-T; Fed-T	Uncommon
	*Sacramento splittail <i>Pogonichthys macrolepidotus</i>	Ca-CSC; Fed-P(T)	Occasional
	Hardhead <i>Mylopharodon conocephalus</i>	Ca-CSC	Uncommon
	Sacramento perch <i>Archoplites interruptus</i>	Ca-CSC; Fed-C2	Possibly extirpated

CODES:

Ca-E (Listed as Endangered by the State of California)  
 Ca-T (Listed as Threatened by the State of California)  
 Ca-R (Listed as Rare by the State of California)  
 Ca-CSC (California Department of Fish and Game "Species of  
 Special Concern")

Fed-E (Listed as Endangered by the Federal Government)  
 Fed-T (Listed as Threatened by the U.S. Fish and Wildlife  
 Service)  
 Fed-P(T) (Proposed as Threatened by the U.S. Fish and Wildlife  
 Service)

Fed-C1 (Category 1 Candidate for listing by the U. S. Fish and  
 Wildlife Service)  
 Fed-C2 (Category 2 Candidate for listing by the U.S. Fish and  
 Wildlife Service)  
 Fed-C3c (Category 3c Candidate for listing by the U.S. Fish and  
 Wildlife Service)

CNPS-1A (California Native Plant Society List 1A Plant)  
 CNPS-1B (California Native Plant Society List 1B Plant)  
 CNPS-2 (California Native Plant Society List 2 Plant)

Species marked with a (\*) are most likely to be found near SB 34 work areas and are discussed in greater detail in Appendix E.



## VI. HABITAT RELATIONSHIPS

Habitats are environments in which an organism or population of organisms normally occurs. They are usually characterized by assemblages of certain types of plants and animals. For the purposes of this document, habitat categories are classified as "levee associated" and "non-levee associated".

### A. Habitat Type Descriptions

The following is a discussion of levee associated habitats which are both aquatic and terrestrial. The quality and the amount of each habitat type in the Delta is discussed.

#### 1. Levee Associated Habitat

The Cowardin classification system, using the nomenclature of the COE, Sacramento-San Joaquin Delta Atlas, 1979, is used to classify habitat types. This system uses classifications such as palustrine emergent, palustrine forested, etc. It does not, however, refer specifically to SRA habitat.

Vegetation growing on levees in the Delta is classified in the SB 34 program by six plant associations which are described below. This nomenclature has been developed as a more convenient and useful alternative to the Cowardin system. Each of these habitat types may also be found in non-levee areas of the Delta.

##### a. Riverine Aquatic Bed (RAB)

Riverine aquatic bed is present on the waterside toe of the levees. It consists of submerged plants growing where the streambed is up to one meter deep U.S. Geological Survey (U.S.G.S.) datum. Typical plant species found here include elodea (*Elodea canadensis*), hornwort (*Ceratophyllum demersum*), and milfoil (*Myriophyllum* spp.). The closest analogue in the Cowardin system is R2AB (Aquatic Bed).

##### b. Freshwater Marsh (FM)

This habitat consists of either tidal or non-tidal freshwater marsh (Figure 6). Areas containing this habitat type are dominated by emergent (protruding out of the water) vegetation.

Tidal Freshwater Marsh (TFM). This habitat is found on the waterside toe of the levee and typically occurs in the slowest moving waters where tules have become established. It can be described as L2EM1 (lacustrine emergent wetland), L2EM2 (lacustrine emergent), and R2EM1 (riverine emergent wetland) in the Cowardin system.

Nontidal Freshwater Marsh (NTFM). This exists in the Delta primarily on the landward side of levees in seeps or toe ditches. This plant community typically includes cattails, common reed, tules, barnyard grass (*Echinochloa crus-galli*), and nutgrass (*Cyperus* spp.). Willows (*Salix* spp.) and other shrubs such as dogwood and button bush (*Cephalanthus occidentalis* var. *californicus*) may become established on the higher margins of this marsh, but are not considered part of it. PEM1 and PEM2 (palustrine emergent wetland) under the Cowardin system describe this habitat type.

#### c. Ruderal (R)

This habitat consists of plants that are frequently and seriously disturbed. Grasses and herbaceous plants dominate this habitat type. Representative species include fennel (*Foeniculum vulgare*), mugwort (*Artemisia douglasiana*), yellow star thistle (*Centaurea solstitialis*), prickly lettuce (*Lactuca serriola*), ripgut grass, mustard, wild radish, stinging nettle (*Urtica dioica* ssp. *holosericea*), giant reed (*Arundo donax*), common reed, Johnson grass (*Sorghum halepense*), and wild oats. The counterpart to this habitat class in the Cowardin system is UP (Upland).

#### d. Scrub Shrub (SS)

This habitat includes areas dominated by trees, shrubs, and vines predominantly less than 6 meters (20 feet) tall (Figure 7). The dominant species include willows, button bush, young white alders, blackberries, wild rose (*Rosa californica*), elderberries (*Sambucus mexicana*), dogwood, and coyote brush (*Baccharis pilularis*). Herbaceous plants such as sedge (*Carex* spp.), stinging nettle, common reed, and mugwort are often intermixed. The counterpart in the Cowardin system is PSS1 (palustrine scrub shrub).

This can be separated into riparian and upland scrub shrub. "Riparian" scrub shrub is distinguished from "upland" scrub shrub in that it is only found on slopes facing the water, such as on the waterside of Delta levees.

#### e. Riparian Forest (RF)

This habitat is characterized by woody vegetation greater than 6 meters (20 feet) tall, often with a dense, shrubby understory (Figure 8). It can consist of individual trees. Cottonwood, sycamore, alder, box elder (*Acer negundo*), valley oak (*Quercus lobata*), and willows are common trees. Blackberries, button bush, wild rose, wild grape, and mugwort are typical of the understory. Cultivated and introduced trees such as eucalyptus (*Eucalyptus* spp.), conifers, and English walnut (*Juglans regia*) fall into this category as well. The counterpart in the Cowardin system is PFO1 (Palustrine Forest).



Figure 6. - Freshwater Marsh Habitat.



Figure 7. - Scrub Shrub Habitat.



Figure 8. - Riparian Forest Habitat.



Figure 9. - Shaded Riverine Aquatic Habitat.



## **f. Shaded Riverine Aquatic (SRA)**

This habitat consists of trees or shrubs extending over water in the channels of the Delta (Figure 9). The dominant species of SRA habitat include willows, alder, cottonwood, and box elder. Plants with limited overhanging and protruding leaves, branches, or roots, such as tules, blackberries, or dogwood, are not considered SRA vegetation for the purposes of impact assessments. Vegetation overhanging seep ditches or blowout ponds is also excluded. There is no counterpart in the Cowardin system for SRA habitat.

## **2. Nonlevee Associated Habitat**

### **a. Agricultural**

This habitat exists mainly as large expanses of flat land on the landside of levees. Agricultural lands in the Delta region are used for pasture, cornfields, winter wheat, alfalfa, row crops, fallow lands, and orchards and vineyards. Some croplands are very valuable to certain wildlife species, while others, such as well managed vineyards and sugar beet fields, are not. Although not directly affected by levee maintenance operations, this habitat could be converted to SB 34 mitigation habitat.

### **b. Native Grasslands**

This habitat is found mainly on the perimeter of the Delta. It consists mainly of native perennial grasses, with some remnants of oak woodland and savannah (grassland with scattered trees). Spring wildflowers typically grow here. This classification is distinguished from ruderal habitat in that it is not dominated by non-native weedy species. An example of this habitat occurs near the Jepson Prairie Vernal pools near Dixon.

### **c. Dunes**

Dunes are arid, sandy substrate habitats that have unique assemblages of plants and animals. The physical environment (wind, high temperature, moisture stress, and infertile soils) require behavioral and/or structural adaptations in plants and animals. Only a small number of species have adapted to these factors, and many are found only in sandy habitats such as the Antioch Dunes, near Antioch. Man-made dune habitats in the Delta have replaced the natural historic habitats for several species.

Many of the dunes which remain today in the Delta have been created by the disposal of dredged sands in upland areas. Channelization of the Sacramento and San Joaquin rivers has precluded most natural river meandering. Thus, erosion and deposition do not contribute to creation of sandbars and other sandy habitats.

#### **d. Vernal Pools**

Vernal pools are naturally occurring pools of water, inundated only in the winter and early spring. Most are formed because hardpan soils prevent water from percolating deep into the soil. Specialized and unique species of plants and invertebrates have adapted to the wet and dry cycles of these pools and these species exist nowhere else.

### **B. Quality and Quantity of Habitat Types**

#### **1. Habitat Quality**

Habitats usually do not stand alone as functioning systems. Most terrestrial and aquatic Delta animals depend on more than one habitat type. For example, the Swainson's hawk depends on grasslands and open fields for foraging and large riparian trees for nesting and perching. Also, most resident native fish species spawn or rear either in the submerged vegetation of marshes or on the edge of riparian habitat, and live as adults in open waters. Many of the following habitat values are based upon the discussion presented in Madrone (1980).

##### **a. Riverine Aquatic Bed (RAB)**

RAB provides valuable food for Delta waterfowl, particularly ducks and coots (*Fulica americana*). Ducks, geese, swans, grebes, coots, and other birds feed on fruits and seeds of a number of aquatic plant species (especially water grass). Shoots, leaves tubers or whole plants are also used by many birds.

These areas are also spawning and nursery areas for resident fish species. They provide cover for adults and juveniles as well as microparticulate food for juveniles.

Aquatic plants in this habitat aid in soil binding by means of plant structures such as roots, rhizomes, and stolons. They enrich the oxygen supply. As with most types of plants having aquatic components, they provide protection and shade for nesting fish as well as provide microparticulate food for their offspring.

RAB plays an important role in the aquatic food chain. Aquatic plants provide a substrate for algae, bacteria, and protozoa. These organisms provide food for crustaceans, mollusks, annelids, and insect larvae, which, in turn, are fed upon by carnivorous fish.

Beavers, muskrats, and other animals use RAB aquatic plants to some degree. Tubers and rhizomes are a rich source of starch, whereas the foliage usually is a good source of sugars (William C. Vineyard, 1970 - unpublished report).

## b. Freshwater Marsh

Tules, reeds, and cattails dominate most of the freshwater marsh in the Delta. Tules may grow up to fifteen feet tall. Consequently, Delta marshes may have the largest above-ground standing plant matter (biomass) of any tidal marshes in North America (Atwater et al, 1979).

Nontidal marshes exist behind levees in the interior of some of the larger islands (Madrone, 1980). They are often associated with lakes or extensive patches of open water, which have relatively calm patterns of flow and deposition. They are often found along in small patches adjacent to drainage ditches in farms.

Brackish tidal marshes are found in the western portion of the Delta. These tidal marshes are home to more than 40 plant species. Plant diversity is higher here than the more saline tidal marshes of Suisun Bay or the salt marshes of San Pablo and San Francisco bays. However, Delta vegetation, both in current and historic Delta tidal marshes, is dominated by only five species or groups of species: tules, bulrush, cattails, common reed, and arroyo willow (*Salix lasiolepis*) (Atwater, et al., 1979).

Tidal marshes are important for many birds and mammals, including several Special Status species such as the black rail and giant garter snake. Tules and reeds provide food and cover for native fish and aquatic mammals such as beavers and muskrats. The Delta's wetlands are valuable assets, providing food-web support, fish and wildlife habitat, and recreational opportunities. Patches of tules, sometimes hundreds of feet long and up to 40-50 feet wide, are found along the perimeter of many leveed throughout the Delta. Such berms provide much needed protection for levees from wind and boat generated wave erosion. Land reclamation has claimed 90 percent of the Delta's original wetlands.

One component of freshwater tidal marsh vegetation is the "tule island" or "berm island". These are remnants of the original islands, left after the channels were dredged and the levees built. These provide important cover and nesting areas for songbirds such as the common yellowthroat and red-winged blackbird, as well as several resident fish species. These pristine freshwater tidal marshes in the Delta may be the only ones left in California. These patches are principally found in wide Delta channels where substrates are deposited high enough for tules and reeds to survive.

## c. Ruderal

This habitat is used by various ground nesting birds. For example, the western meadowlark, horned lark (*Eremophila alpestris*), northern harrier, and ring-necked pheasant conceal their nests in the vegetation. Some waterfowl, such as the mallard and cinnamon teal, nest in ruderal areas. Ruderal areas in the Delta provide foraging habitat for sandhill cranes and migratory shorebirds and geese (USFWS Planning Aid Report, 1993). Raptors such as the Swainson's hawk, northern harrier, white-tailed kite, American kestrel, short eared-owl, and loggerhead shrike also rely on ruderal areas for foraging.

#### d. Scrub Shrub

Upland scrub shrub provided cover and breeding, roosting, and foraging habitat for many birds. Common species using shrub scrub include white-crowned sparrows, American goldfinches (*Carduelis tristis*), rufous sided-towhee, house finch (*Carpodacus mexicanus*), scrub jay, bushtit (*Psaltiriparus minimus*), and other species (Madrone, 1980; USFWS, 1993).

The linear arrangement of the shrubby growth near waterways provided a protected travel corridor for small birds during daily or migratory movements. Large diameter trees in scrub shrub (and riparian forest) habitat also provide critical nesting sites for species such as wood ducks, Swainson's hawks, and downy woodpeckers (USFWS, 1993).

#### e. Riparian Forest

This habitat is created by the layering of trees, shrubs, vines, and herbaceous and aquatic vegetation. This structure promotes high wildlife species diversity. The shape of riparian zones (e.g., narrow corridors) maximizes the extent of edge habitat, thereby increasing species diversity. A great number of species, such as hole-nesting or bark-gleaning birds, are completely dependent on this habitat type for existence. For many other species, the riparian zone is a critical element of their life history needs (USFWS, 1993).

Riparian habitat is used by more vertebrate wildlife, 107 species, than any other Delta habitat type (Madrone, 1980) because of the dense and diverse canopy structure, and abundant leaf and invertebrate biomass production. Species diversity and population numbers of resident and migratory birds are especially high in Central Valley riparian habitats (Gaines, 1977).

Riparian vegetation, supports abundant insects in the canopy leaf litter, and tree and shrub bark. This provides a food base for a variety of birds and some mammals. Where the vegetation overhangs the water, these insects can be a significant part of the diet of resident fish populations.

Raptors, as well as herons and egrets, seek height and nest or perch on riparian woodland trees. Many habitats share structural features with riparian habitats and can serve effectively as "riparian surrogates" (Dennis et al., 1984). Levees, ditches, and abandoned land may combine proximity to water with shrubs or trees, providing the vegetation structure favored by many mammals. Riparian surrogates may also serve as important dispersal corridors between true riparian and wetland habitats.

Riparian plant species can survive seasonal, but not permanent, flooding. They are found on the high ground of levees and river floodplains. Riparian habitat is commonly found on the banks of waterways, including man-made levees which are not kept cleared. Riparian vegetation is also supported on the interior of some Delta islands.

In the Central Valley as a whole, more than 90 percent of the historical riparian forests are gone. They were cleared for firewood, agriculture and levee building. Urban development and traditional levee maintenance practices are causing further losses of this habitat.

#### **f. Shaded Riverine Aquatic Vegetation**

SRA habitat provides significant benefits for aquatic organisms, especially fish, who find protection, food and shade under and among the vegetation. Two Special Status fish that are believed to benefit from the presence of SRA are chinook salmon and Delta smelt. It is believed by biologists who work with the species that out-migrating juveniles find escape cover and food along shores with SRA attributes, although this is not well documented in the Delta.

Overhanging SRA vegetation provides food for fish in the form of various insect species which feed upon leaves and twigs which fall into the water and subsequently provide food for fish.

SRA habitat benefits not only for fish, but also reptiles and amphibians, birds, and mammals. Birds species which have been observed using SRA vegetation in the Delta include birds such as warblers, ruby-crowned kinglets (*Regulus calendula*), belted kingfisher, Coopers's hawk, and many others. This habitat also provides burrowing sites used by large fur-bearing mammals, including river otter, weasel, beaver and muskrats. These and other mammals use SRA for access and egress from shore to water.

SRA habitat has been recognized by the USFWS, the NMFS, and the DFG as one of most valuable habitat types in the Delta. It was approved for a Resource Category 1 designation by the USFWS for portions of the Sacramento River, including reaches in the Delta, thus providing for "no loss of habitat values" during the review and planning purposes. SRA habitat has the highest habitat values along banks which have not been ripped.

Components of this habitat valuable to fish include submerged tree roots and branches, exposed roots, overhanging vegetation, relatively uneven natural banks, and relatively shallow low-velocity areas near the shoreline.

Flood control levees, constructed at the turn of the century on top of the existing, natural sediment berms, resulted in the removal of most of this habitat. Consequently, SRA habitat is of special concern to both FWS and DFG, and its further demise as a result of reclamation district maintenance and rehabilitation is discouraged.

#### **g. Agricultural**

Agricultural land is useful for waterfowl and other resident and migratory waterbirds, small mammals, raptors, upland game birds, and passerine birds.

Biologists of the DFG Bay-Delta Division have assigned numerical values (scale of 1 to 5) for various Delta crops for many Delta birds, mammals, reptiles, and amphibians.

These values were determined based on observations of biologists working in the Sacramento-San Joaquin Delta and researchers evaluating agricultural lands in the Central Valley of California and elsewhere in the United States. Table 3 displays the acreage of crop types in the Delta based on a land use survey conducted in 1993. Corn, grassland, and alfalfa were among the most valuable crops for wildlife, whereas crops such as tomatoes or squash were of lower value to most species.

Delta agricultural fields are important producers of biomass, not only for obvious commodity values, but for wildlife as well. During the winter, large numbers of waterfowl and shorebirds forage on the Delta agricultural lands, especially row crops, pastures and fallow fields.

**Table 3. - Relative Abundance of Agricultural Crop Types in the Delta, 1993 (DFG, 1995).**

Crop Type	Acres	Relative Abundance
Wheat/Barley	87,560	16.9%
Alfalfa	76,798	14.8%
Fallow field crops	69,740	13.5%
Corn	51,457	9.9%
Tomatoes	43,852	8.5%
Idle	31,554	6.1%
Pasture	30,283	5.8%
Sugar beets	27,877	5.4%
Asparagus	23,548	4.5%
Deciduous fruit and nut trees	21,686	4.2%
Beans (dry)	10,745	2.1%
Vineyards	10,071	1.9%
Safflower	7,812	1.4%
Fallow truck crops	6,132	1.2%
Other	18,983	3.7%
Total	518,098	100%

As noted, intensive agriculture is the predominant land use in the Delta. The flat topography and excellent soils, combined with riparian and appropriated water rights, produce high yields. DWR estimated the value of Delta farm products to be nearly \$375 million in 1987.

The value of agricultural land to waterfowl is closely tied to cropping and flooding patterns, which can vary from year to year (USFWS, 1978). For example, leftover stubble from summer corn production is extremely valuable for wintering waterfowl. Alternating this with winter wheat production produces nesting areas and food for waterfowl and upland game



birds.

Probably the most widely recognized value of agricultural habitat to wildlife is its value to waterfowl. Much of the value of agriculture for waterfowl in the Delta comes from the practice of flooding fields in the winter to leach out salts (Rollins 1977; USFWS, 1978; Michny 1979 in USFWS biological Report 85(7.22) 1989). The flooding of agricultural fields is of most value to ducks, whereas geese can make better use of dry fields.

Migrating waterfowl often arrive in the Delta as early as late summer. At that time, there is often a shortage of waterfowl feeding areas. To help solve this problem, there has been a tendency to flood agricultural fields earlier in the season than has occurred in the past. In the case of Staten Island, portions of the island are flooded as early as September 10. Individual fields of the island are flooded typically to a depth of less than one foot, and alternate fields are flooded throughout the fall and winter. The flooded fields are separated by earthen dikes developed from the peat soil on the islands.

Corn, probably the most valuable post harvest crop to waterfowl, is among the most salt-sensitive crops (Madrone, 1980), so corn fields require regular leaching (Rollins, 1977, in USFWS biological report 85).

#### **h. Native Grasslands**

These habitats have been replaced throughout California by non-native annual grass and weed species. Non-native species provide only limited habitat values to the native animals of the Central Valley grasslands. One significant remnant of native grasslands is found at Jepson Prairie Preserve in the northwestern part of the Delta.

#### **i. Dunes**

Dunes provide limited habitat values for most species. Only a few plant and animal species are found there. However, they are ecologically very important. Typically, dunes are of rather limited size as well and are often isolated from other similar habitats. As a result, dunes often support species found nowhere else. Delta dunes provide the only known habitat for the federal Endangered Lange's metalmark butterfly (*Apodemia mormo langei*). Two federal Candidates, the Antioch dunes anthicid beetle (*Anthicus antiochensis*), and the Sacramento anthicid beetle (*Anthicus sacramento*) are also found in Delta dune habitats. State and Federal Endangered Plants present are the Antioch Dunes evening-primrose (*Oenothera deltoides* ssp. *howellii*) and the Contra Costa wallflower (*Erysimum capitatum* var. *angustatum*).

## j. Vernal Pools

More than 200 plant species, 91 percent of which are California natives, occur in vernal pools statewide (Holland, 1976). Delta vernal pools support a number of Rare, Threatened or Endangered plants, as well as a Federally-listed Threatened insect, the Delta green ground beetle. Vernal pools have been destroyed by overgrazing, paving, cultivation, and other development activities.

## 2. Habitat Quantity

There have been recent studies indicating the quantity of various habitat types in the Delta. However, there is no current assessment of the quantities of all of the aforementioned Delta habitat types. Little native riparian or marsh habitat remains in the Delta, and most native vegetation exists in small, isolated remnants.

It is difficult to develop an accurate summary of the amounts of levee associated habitat available at any given point in time. There is continual removal and regrowth of vegetation, such that it is difficult to obtain a "snapshot in time". In areas where slower growing vegetation types predominate, such as oak trees, this is less of a problem.

Habitat assessments of properties governed by individual reclamation districts are a main source of information regarding the location and amount of habitat of various types in the Delta. To date, they have been developed for levee-associated habitat for a total of 26 reclamation districts as a condition of approval for annual SB 34 workplans. Typical components of these assessments include the amount of each major habitat type associated with an individual reclamation district. Vegetation types are mapped. Known or expected plant and animal species are identified. Assessments were prepared by consultants for Delta reclamation districts, mainly between 1990 and 1992 by conducting field surveys.

The report prepared by Harding Lawson Associates, dated April 30, 1994, surveyed the following habitat types: freshwater marsh (PEM1, R2EM1), scrub shrub (PSS1), palustrine forest (PFO1), and SRA. This included an evaluation of habitats along non-project levees on SB 34-participating districts in the Delta between July 1, 1987 and June 30, 1991. The determinations of habitat were made by interpretation of aerial photography and subsequently about seven percent of the non-project levee miles under study were verified by field inspections. It was prepared for a total of 49 Delta reclamation districts. Table 4 provides a summary of the amount of each habitat type calculated for 1991. To refine shrub scrub (PSS1) calculations, monotypic stands of giant reed and blackberries were excluded. Other reports which quantify habitat areas include USFWS inventories of SRA habitat conducted in 1987-88 and wetland habitat and land use surveys by DWR.

A summary of types and amounts of each was made for those reclamation districts participating in the SB 34 program. This information is presented in Table 5. The table was compiled using existing habitat assessments which were prepared for districts participating in

**Table 4. - Summary of Habitat Types and Area of Each Occurring along Nonproject Levees in the Sacramento-San Joaquin Delta, 1991 (Harding Lawson Assoc., 1994).**

District	PEM1 (acres)	R2EM (acres)	PSS1 (acres)	PFO1 (acres)	SRA (linear feet)
Bacon	0.47	8.49	17.12	0.62	580.98
Bethel	1.94	0.64	27.38	24.23	7,183.18
Bishop	1.47	2.17	9.90	1.29	333.30
Bouldin	7.96	7.71	47.40	3.54	2,719.71
Brack	3.45	2.67	22.28	7.99	4,663.11
Brannan-Andrus	0.70	0.00	21.71	14.87	10,278.22
Byron	4.90	3.02	8.20	1.15	0.00
Canal Ranch	0.51	3.00	10.46	4.55	2,960.06
Coney	1.33	1.92	15.97	1.75	3,489.10
Empire	0.89	3.84	6.97	1.86	0.00
Fay	0.25	0.18	4.12	4.06	3,970.65
Glanville	0.10	1.51	9.07	53.66	13,525.09
Holland	2.13	0.77	75.10	15.69	3,840.08
Hotchkiss	1.15	1.90	9.21	6.11	1,232.23
Jones, Lower	7.30	2.52	24.18	7.05	1,360.00
King	2.70	1.52	7.16	4.99	284.29
Little Mandeville	0.55	0.50	10.71	3.60	1,396.18
Mandeville	0.92	5.84	27.75	0.24	241.56
McCormack-Williamson	11.33	1.31	17.30	26.79	10,968.25
McDonald	9.13	5.82	48.37	5.86	2,290.00
Medford	0.12	4.14	20.08	5.02	1,120.81
New Hope	0.99	2.74	34.64	21.50	23,545.62
Orwood	4.07	1.26	11.00	3.99	1,180.11
Palm	1.80	4.06	9.98	1.50	1,233.17
Pescadero	0.05	0.00	6.78	4.80	621.73
Prospect	0.15	0.11	26.82	9.51	2,437.22
Quimby	0.34	3.62	9.46	2.30	0.00
Rindge	0.86	2.08	20.17	1.86	0.00
Rio Blanco	6.36	2.52	9.49	2.92	650.00
Roberts, Lower	2.01	5.61	52.60	41.85	12,650.00
Sargent-Barnhart	1.96	0.14	4.11	8.86	1,187.69
Sherman	3.13	1.29	90.59	11.85	3,787.04
Shima	0.05	1.75	3.12	11.53	550.49
Smith	0.00	0.00	0.64	5.92	2,395.76
Stark	0.15	0.06	1.26	1.37	2,149.76
Terminous	17.54	6.09	41.09	19.36	1,910.00
Twitchell	0.76	1.93	22.04	6.16	8,434.60
Tyler	9.95	3.19	38.82	3.63	2,900.00
Union, East	1.76	0.35	92.06	50.86	42,300.00
Union, West	10.02	1.54	37.75	9.95	26,922.70
Upper Andrus	1.78	0.00	2.65	0.41	0.00
Venice	0.64	2.77	18.40	5.79	344.73
Victoria	22.95	8.89	6.49	1.51	1,204.58
Webb	8.13	5.10	70.54	2.28	138.60
Webber	0.00	0.00	1.17	5.98	5,671.39
Winter	0.00	3.57	36.92	0.00	90.00
Woodward	1.45	4.88	4.22	2.73	0.00
Wright-Elmwood	10.28	1.03	20.63	31.16	6,640.00
Totals	166.48	124.05	1,113.88	464.5	221,381.99

**Table 5. – Available Summary of Habitat Types and Area of Each Found Along Nonproject Levees in the Sacramento-San Joaquin Delta.**

Tract/Island	RD No.	Levee miles	RAB (acres)	FM (acres)		SS (acres)		RF (acres)		SRA (lin. ft.)	R (acres)	Source
			Aquatic bed	Riverine marsh	Palustrine marsh	Scrub shrub	Berries	Riparian forest	Urban/Cultivated	Shaded riverine	Ruderal	
Bacon	2028	14.3	11.0	5.0	0.3	2.7	0.7	0.1	3.4	304	180.6	Kjeldsen/Arnold, 08-91
Brack	2033	10.8	4.3	0.2	0.1	0.9	0.2	0.9	5.9	1,351	95.7	Kjeldsen/Arnold, 04-91
Bradford	2059	7.4	—	—	—	—	—	—	—	7,000	180.0	RES Ass., Inc., 08-93
Brannan-Andrus	2067	10.1	—	0.6	—	—	—	—	3.0	22,300	180.0	RES Ass., Inc., 02-91
Byron	800	18.9	9.6	1.3	—	0.3	0.3	—	0.5	—	115.7	Kjeldsen/Arnold, 08-90
Canal	2086	7.5	—	0.5	—	—	—	—	—	2,400	720.0	RES Ass., Inc., 04-91
Fay	2113	1.6	—	< 0.1	1.0	3.4	—	0.6	0.2	2,900	—	Kjeldsen/Arnold, 08-94
Mandeville	2027	14.3	—	4.5	< 0.1	1.4	0.4	0.2	1.6	185	169.2	Kjeldsen/Arnold, 04-92
McCormack-Wll.	2110	8.8	—	< 0.1	—	—	—	0.7	—	41,500	109.5	RES Ass., Inc., 08-92
Medford	2041	5.9	7.4	2.4	0.3	0.2	< 0.1	4.5	2.3	—	74.3	Kjeldsen/Arnold, 06-91
Orwood	2024	7.9	5.3	0.2	0.4	0.3	< 0.1	1.7	1.7	160	68.6	Kjeldsen/Arnold, 05-91
Palm	2038	7.6	2.5	1.0	—	0.9	1.9	< 0.1	3.4	382	59.3	Kjeldsen/Arnold, 07-91
Pescadero	2058	2.5	—	< 0.1	—	0.4	—	0.5	—	455	—	Kjeldsen/Arnold, 01-92
Roberts, Lower	684	14.6	—	0.2	0.6	0.8	2.7	13.0	—	2,390	—	Kjeldsen/Arnold, 05-91
Sherman	341	9.8	—	7.7	—	2.7	—	1.5	0.3	345	109.2	Kjeldsen/Arnold, 01-93
Shima	2115	6.6	—	1.3	—	< 0.1	< 0.1	0.1	12.5	245	—	Kjeldsen/Arnold, 04-91
Smith	1614	2.8	—	0.1	—	0.2	—	—	1.5	5,755	1.7	Kjeldsen/Arnold, 02-91
Stark	2089	0.8	0.1	—	0.1	1.0	—	0.3	—	620	0.6	Kjeldsen/Arnold, 10-91
Twitchell	1601	11.9	—	6.4	—	—	—	—	—	—	170.0	RES Ass., Inc., 02-91
Tyler	563	10.7	0.3	1.3	0.2	0.1	—	2.3	—	425	137.9	Kjeldsen/Arnold, 04-91
Union, East	1	13.0	2.5	< 0.1	0.1	7.9	—	3.9	4.1	2,043	109.1	Kjeldsen/Arnold, 11-91
Union, West	2	16.2	18.7	0.8	—	0.6	—	0.4	0.6	645	69.1	Kjeldsen/Arnold, 10-90
Venice	2023	12.3	—	0.2	0.3	0.7	< 0.1	8.1	3.1	40	—	Kjeldsen/Arnold, 04-91
Victoria	2040	15.1	19.8	3.8	0.6	0.4	—	0.7	0.8	160	193.6	Kjeldsen/Arnold, 02-91
Woodward	2072	8.8	7.2	3.7	—	1.1	1.2	1.3	—	10	—	Kjeldsen/Arnold, 07-91
Wright-Elmwood	2119	7.1	1.4	0.3	< 0.1	0.9	0.4	0.6	5.5	1060	65.3	Kjeldsen/Arnold, 01-92

(-) not surveyed

the program. The presence of a dash (-) in any column indicates that the particular habitat type was not surveyed for. The earlier assessments did not include the amounts of habitat. Therefore, only those assessments which have quantified habitat are included for this table.

Quality of vegetation was not evaluated. Much of the vegetation on the levees is spatially fragmented because of levee maintenance activities, and will be of less value for wildlife than an equivalent acreage of the same habitat where adequately buffered.

#### **a. Riverine Aquatic Bed**

An inventory of this habitat type was conducted for the COE Delta Atlas. During this time period, a total of 145 acres of RAB was documented.

#### **b. Freshwater Marsh**

Tidal marshes, once the most widespread habitat in the Delta, are now restricted to remnant patches. Most freshwater marsh in the Delta is subject to tidal influence. The current ratio of tidal vs. non-tidal marsh is not reported. However, out of about 358,400 acres of tidal wetlands which covered the Delta, only about 5,210 acres existed as of 1979 (Atwater, 1979, in Madrone, 1980). Estimates of the present extent of both nontidal and brackish marshland in the Delta as of 1980 ranged from 9,000 to 11,000 acres (Madrone, 1980).

An inventory of biological resources was completed in 1985 by the USFWS (USFWS, 1993) (Table 6). These are believed to be the most current figures for the amount of freshwater marsh in the Delta.

There are also remnant non-tidal marshlands found in the interior of Delta Islands and in the Stones Lakes complex of the north Delta.

**Table 6. - Wetland and deepwater habitats of the Sacramento-San Joaquin Delta according to the 1985 National Wetlands Inventory (USFWS, 1993).**

Wetland Habitat Type	Acreage
Seasonal (farmed) wetland	350,347
Open water	45,802
Diked nontidal wetland	16,502
Riparian woodland	9,788
Tidal freshwater marsh	8,223
Intertidal mudflats	322
<b>Total</b>	<b>430,984</b>

#### **c. Ruderal**

There is no summary available of the amount of ruderal habitat in the Delta.

#### **d. Scrub Shrub**

There are no recent or comprehensive surveys of scrub shrub habitat in the Delta. The amounts of scrub shrub found at various reclamation districts is indicated in Tables 4 and 5.

#### **e. Riparian Forest**

There is no current Delta-wide inventory of riparian forest. Tables 4 and 5 provide indicates the amount of riparian forest which has been calculated for selected reclamation districts. According to the habitat assessments which have been prepared for the SB 34 program, there were relatively large amounts of riparian forest at such districts as Lower Roberts and Medford.

#### **f. SRA**

The USFWS surveyed a total of 23 Delta channels and islands in 1987 and 1988. The amounts of SRA cover found during that survey are shown in Table 7. Note that the table refers to "heavily-shaded" riverine aquatic. This is the same as SRA vegetation.

The discrepancies between amounts of SRA vegetation reported by Harding Lawson and that in the USFWS report are apparent in many instances. For example, the USFWS reported that on McCormack-Williamson tract there were a total of 29,525 lineal feet of SRA vegetation in April 1988, whereas the Harding-Lawson report reports only 11,870 lineal feet of SRA vegetation in 1987. In this instance, consideration of greater credibility should be given to the USFWS estimate because the survey was conducted by boat, whereas the Harding Lawson estimates were conducted largely by examination of aerial photos. Further, the Harding Lawson determinations specifically excluded blackberries, which are common at McCormack-Williamson Tract. The USFWS report apparently did not. However, the DFG SB 34 program does not include blackberries as SRA vegetation.

Table 7 indicates that besides the very low total amount of SRA cover found in the Delta, the distribution of this habitat is highly uneven. Most of the SRA cover was reported on portions of only seven Delta islands: Brannan Andrus, Middle Roberts, New Hope, McCormack-Williamson, Staten, Union, and Upper Roberts. Subsequent habitat assessments reveal that habitat quantity and distribution has changed since 1988.

#### **g. Agricultural**

The amount of land in the Delta which is in agriculture is described in Section IV-A (Land uses). The present-day Delta is mostly farmland, which comprises over 86 percent of the dry land surface area. The wildlife habitat value of these lands depends on agricultural practices like flooding regimes, pesticide and herbicide applications, and tillage.

#### **h. Native Grasslands**

There are no recent or comprehensive surveys of the amount of this habitat type in the Delta.

**Table 7. - Heavily-Shaded Riverine Aquatic (HSRA) Cover Around Selected Islands and Tracts within the Sacramento-San Joaquin Delta (DeHaven, 1988).**

Island or Tract <sup>a</sup>	All levees surveyed?	Levees Surveyed (linear feet)	HSRA Cover (linear feet)	% HSRA Cover
Bacon	Yes	75,000	1,780	2.4
Bouldin	Yes	97,000	0	0.0
Brannan/Andrus	No	186,350	64,331 <sup>b</sup>	34.5
Byron	Yes	12,400	0	0.0
Canal Ranch	No	30,800	0	0.0
Coney	Yes	29,000	2,300	7.9
Deadhorse	Yes	15,500	0	0.0
Empire	Yes	55,200	0	0.0
Jones, Lower/Upper	Yes	101,800	1,654	1.6
Mandeville	Yes	76,300	100	0.1
New Hope	No	42,400	17,200	40.6
McCormack/Williamson	Yes	36,000	29,525	82.0
McDonald	Yes	71,900	0	0.0
Rindge	Yes	74,700	0	0.0
Roberts, Lower	No	30,500	2,420	7.9
Roberts, Middle/Drexler	Yes	61,600	10,423	16.9
Roberts, Upper	No	24,600 <sup>c</sup>	22,943 <sup>c</sup>	93.3 <sup>c</sup>
Staten	Yes	137,800	7,830	5.7
Terminous	Yes	96,400	0	0.0
Tyler	Yes	123,800	37,688 <sup>c</sup>	30.4
Union	Yes	146,800	11,625	7.9
Victoria	Yes	79,200	1,355	1.7
Webb	Yes	68,100	0	0.0
Totals		1,673,150	211,253	12.6

<sup>a</sup> Only the exterior, leveed channels around the islands and tracts are included. Any HSRA cover along channel islands or smaller than 100 feet long are excluded.

<sup>b</sup> Includes HSRA cover for Sacramento river (partial) and Georgiana Slough reported in Part I of the HSRA inventory.

<sup>c</sup> Only Middle River south of Howard Road was surveyed. Other levees surrounding this island have much less HSRA cover and were not surveyed.

#### i. Dunes

The amount of dune habitat in the Delta is unquantified, except for the Antioch dunes, which consists of a total of about 70 acres. However, some information regarding the location of dune habitat is available. In the Delta, dune sites are limited to only a few areas, mainly along the Sacramento and San Joaquin rivers. Dune habitat has been documented at the following locations: Brannan State Recreation Area, Antioch Dunes, the southwestern tip of Grand Island, and two small dune areas near Rio Vista (Davis, 1982, Masters Thesis). The sites at Antioch Dunes, sites near Rio Vista, and the site near Grand Island have been formed by the deposition of dredge sands in upland areas.

It appears that this habitat has been reduced greatly in the Delta, notwithstanding the placement of dredged sands in uplands areas. Hagen (1986, as reported by Davis, 1982)

indicated that dune habitat has been significantly reduced in distribution and abundance by bank protection, water diversion, dam building, and flood control channelization projects.

#### **j. Vernal Pools**

The amount of vernal pool habitat in the Delta has not been quantified. Vernal pools are found within grassland areas near Byron and at the Jepson Prairie near Dixon. They are not likely to be found in most of the Delta because of porous organic soils or sand.

### **C. Relevance to Topographic Features**

The following habitats are described relative to their proximity to physical structures, such as islands, levees, and submerged shoals. The description is broken down into levee associated and nonlevee associated habitat. "Associated" refers to having a direct physical attachment.

#### **1. Levee Associated Features**

##### **a. Levees**

The levees themselves provide valuable habitat for fish and wildlife, both on the landside and waterside.

Most Delta levees have been subjected to annual maintenance actions for more than 50 years. Consequently, much of the vegetation seen on the levees today is represented by opportunistic, weedy and often non-native plant species that thrive in disturbed soil conditions. These plants are often referred to as ruderal and include such species as wild radish, nettle, Bermuda grass (*Cynodon dactylon*), milk thistle, and giant reed.

Levees which are part of the Sacramento River Flood Protection Project are known as "Project Levees". Project levees differ from nonproject levees in that they are generally wider and taller, and are maintained to Federal standards.

There are no available studies which compare the habitat values of project levees with nonproject levees. Many COE standard levees have earthen berms along the waterside toe. An example is along the Sacramento River near Isleton, where mature cottonwoods and willows grow on the berms. However, the COE levees require quarry rock on the levee surfaces; if there is a slip, then the reclamation districts clear vegetation before placing new rock. There are design manuals for project levees on Sacramento River, such as between Collinsville and Chico Landing, which allow for the placement of trees. This is possible because the berms along the lower Sacramento River are fairly wide. Designs allow planting on the upper part of the levee near the high water line (annual tidal cycle). There is more maintenance on project levees, but because they are solidly built, they allow areas where habitat can become established.

Conversely, habitat on nonproject levees is often established because maintenance that has been deferred for a long period of time usually results in the development of riparian forest habitat on the levees.



Farmers have often used herbicides to remove levee vegetation. This removal is mainly of low growing, ruderal vegetation.

An estimated 1,100 miles of levees are in the Delta. About 75% of these are nonproject levees. These are the only levees available for funding in the SB 34 program. About 65 percent of these are nonproject levees (DWR, 1994).

Levees can have the following habitat types: RAB, FM, R, SS, RF, and SRA. The only part of the levees where SRA vegetation is found is on the waterside.

#### **b. Levee Berms**

Levee berms are earthen shoulders that extend horizontally from the waterside or landside toe of levees. In the context of this report they are considered terrestrial habitats. However, some waterside berms are submerged part of the time. For some of the berms, there is an abrupt gradient change near the water line. Others flatten out gradually into shallow water shoal areas.

Some levee berms exist naturally, and result from accretion of sediments or are remnants of the original islands. Others have been created. A few naturally occurring berms attached to levees occur throughout the Delta.

The M & T Ranch, in coordination with the SB 34 program, developed about 1,500 feet of levee berm habitat at Staten Island in 1992 and 1993. These berms consist of rock dikes with earthen fill placed landward of the rock.

The levee berms at Staten Island are habitat for various fish and wildlife species. Six months after they were constructed, they were almost completely covered with bulrushes, trees, shrubs, and herbaceous plants. This was as a result of plantings and natural colonization. During SB 34 surveys conducted in 1992 and 1993 by DFG personnel, a total of 78 plant species were documented by the Department at the 1992 berm site about 26 months after project construction (Baba and Perrine, 1994).

Levee berms have been established along various COE project levees, including along Georgiana Slough and the Sacramento River. Many of these berms only have value as terrestrial habitats because they are above tidal influence. Further, vehicular access and associated use by the public, including anglers, has the potential to reduce the habitat values of these areas.

### **2. Nonlevee Associated Features**

#### **a. Seep Ditches**

Seep Ditches, otherwise known as toe drains, are parallel to and usually less than 50 feet from the landside toe of the levee. Their purpose is to collect water which seeps through the levee, and to channel the water to collection points where it is routed elsewhere. Seep ditches are typically four to eight feet in width and perhaps six feet in depth. The sides of

these ditches tend to be lined with cattails, wild blackberries, Himalaya berries, and other species.

The value of seep ditches as fish and wildlife habitat is not well documented. However, cattails and bulrushes are habitat for red-winged blackbirds, egrets, and perhaps other species.

#### **b. Channel Islands**

Channel islands are one of the most significant habitat resources and one of the most threatened in the Delta. Most of these islands are remnants of the original land, cut off by dredgers when the levees were built. There are no levee systems. They are within open water channels of the Delta.

The topography of the islands tends to be very flat, with gradients typically less than 5 percent. The shoreline often has a vertical edge, visible at low tide, where there is evidence of erosion of peat soil.

Channel islands are found throughout the Delta and range in size from less than one quarter acre to greater than 200 acres (e.g., Decker Island).

Channel islands are the only known remnants of the original wetlands of the Delta, which have for the most part remained outside of the reach of human intervention. Some are remnants of levees where islands have flooded and not been reclaimed. In many cases, the origin of the islands is unknown. In the case of Venice Cut and Donlan Island, the channel islands are remnants of leveed islands. Venice Cut is a peninsula of Venice Island that was cut off when the Stockton Ship Channel was built. Donlan is a flooded island. Fill material has been placed at various locations on the interior of these islands for biological enhancement.

Channel islands enjoy little protection from use as recreation sites. Illegal marinas and piers, as well as unauthorized boat camping has occurred at some channel islands in the Delta. Dredging required to create the Stockton Deep Water Ship Channel eliminated all or portions of many channel islands. However, in creating this channel, peninsulas were cut off of Venice and Mandeville Islands, thereby creating two large channel islands.

Habitat types found on and around these islands includes the following: Riverine Aquatic Bed, Riverine and Palustrine Emergent (freshwater marsh), Scrub Shrub, Palustrine Forest (riparian forest), and Shaded Riverine Aquatic. The vegetation of many of the islands is dominated by stands of bulrushes. The vegetation of those islands with areas of higher elevation tends to be dominated by willows, dogwood, alders, and other woody vegetation. Some islands have large amounts of SRA vegetation.

There has been no comprehensive survey of channel islands on a Delta-wide basis. The total number of channel islands in the Delta and the total acreage of the channel islands are unknown, as are the habitat values of many of the islands.

Most channel islands are in the central and southern Delta (Madrone, 1980). Areas include Disappointment Slough, White Slough, Potato Slough, the San Joaquin ship channel, Old River, and Middle River. Size, configuration, and vegetation of the islands are variable, but they are all surrounded by water and geographically isolated from the more intensively used agricultural portions of the Delta.

Some islands receive high seasonal use from houseboaters and water skiers. Most are privately owned and infrequently used.

There is abundant evidence from maps, aerial photos, and other sources that many islands throughout the Delta are diminishing in surface area. Some no longer exist as islands and are now shoals. The rate of loss of these islands has not been calculated. However, some channel islands, including those around Staten Island, have decreased considerably in size. Three of these islands, sites for the 1994 mitigation project, have shown significant decreases in size since 1937. Only about one-third of the land which was present on one of these islands in 1937 was present in 1994. Evidence regarding other islands in the Delta indicates that the rate of loss of area of these islands is rapid, and some of the smaller islands may become shoals within the next decade.

There are no studies available indicating whether new channel islands are being formed elsewhere, through accretion of sediments or other processes, replacing those which have been lost. There are records of islands being lost, but none to date of islands recreated. Much of the sediment in rivers feeding the Delta is captured behind dams, never to contribute to accretion in the Delta.

Specific reasons for the loss of the islands is inconclusive. However, the main cause is believed to be erosion from boat wakes. Additional erosion of the islands is caused by wind fetch.

Staff of the DFG SB 34 project have completed some recent detailed surveys of channel islands. Surveys were completed in 1994 at three islands in the South Fork Mokelumne River near Staten Island for the SB 34 program to document pre-project and post-project habitat values (Gray and Baba, 1994). The main element of this project was the placement of rock riprap about 20 feet outward from the main channel side of the islands. A total of 29 plant species, including four Special Status plant species, and 20 bird species have been documented at Island #5. It is likely that further required annual monitoring by the DFG will document many more. Some of the bird species documented to date include the following: American pipit (*Anthus spinoletta*), sora rail, marsh wren (*Cistothorus palustris*), yellowthroat, and yellow warbler. Fish species found in the aquatic vegetation along the shoreline of this island included : chinook salmon, splittail, tule perch, and Sacramento sucker. All of these are native species. Introduced species included redear sunfish, largemouth bass, and black crappie (*Pomoxis nigromaculatus*).

Many Special Status plant species (e.g., Mason's lilaeopsis, Delta mudwort, and California hibiscus) grow on these islands. It is likely that the islands serve as an important seed source for populations of these plants which become established on the levees.

Other extensive surveys of channel islands have been completed at Donlon Island and Venice Cut by the COE (England and Naley, 1989). These surveys were completed by the USFWS and the COE in 1990. These islands consist of a mixture of remnant levees and deposited dredge material. The habitat values of these areas are well documented, including the presence of cattails and bulrushes.

Wooded islands occur throughout the Delta, but are nowhere common (Madrone, 1980). Five Fingers Island, in Middle River between Connection Slough and Columbia Cut, and Sycamore Island, in the South Fork Mokelumne River near the confluence of Sycamore Slough, are examples of such islands where woody vegetation forms a dense thicket of willows and similar species. Beaver, river otter, and muskrats are common on these islands.

Channel islands have been used as disposal sites for major channel dredging (e.g., Decker Island, Venice Cut Island, and Donlon Island). And because deposition of streambed sediments is a natural deltaic process, many native plants are adapted to periodic disturbance and apparently are able to recolonize the dredge spoils sites as well. However, deposition of dredge spoils may cause major changes in the ecological nature and habitat value of the site.

#### c. Farmland

Farmlands are typically of flat terrain and protected from flooding by levees. The farmlands of the Delta are critically important habitat for wintering waterbirds including shorebirds, geese, swans, ducks and sandhill cranes, supporting 10 percent of all waterfowl wintering in the state. During the winter, many fields are flooded with shallow water, enhancing their value to ducks, geese, and swans (Madrone, 1980; Rollins, 1977). Much of the Delta farm acreage is corn, which has particularly good forage value for geese and swans (USFWS, 1978).

Relatively few waterfowl food habits studies have been conducted in the Delta. Tate and Tate (1966, in USFWS, 1993) in a study near Stockton, reported that tundra swans fed on waste corn in both flooded and non-flooded fields as well as potatoes in flooded fields. Geese may feed on germinating grain, tundra swans often feed on waste corn, and mallards and pintails commonly feed in both harvested and unharvested grain fields. Northern pintails feed extensively on barley, rice (Bellrose 1980, in USFWS, 1993) corn, and other cereal grains in the Delta.

Open fields have large populations of small animals such as rodents, reptiles and amphibians providing opportunities for raptor foraging. Nonflooded fields and pastures are also habitat for pheasant, quail and doves.

#### d. Channels and Open Water

Major open-water food web species are phytoplankton, zooplankton and fish. Bottom sands and muds support high numbers of benthic (bottom dwelling) species, dominated presently by the Asiatic clam (*Corbicula* spp.). In lakes, ponds and quiet sloughs, aquatic plants such as the duckweed and non-native water hyacinth can form dense floating mats during the growing season. Open water habitats are also used by a number of bird species which feed on aquatic

invertebrates and fish, such as diving ducks and grebes, and waterfowl such as mallards and wood ducks which feed on submerged aquatic plants.

Channel and open water types include the following: interconnected channels, dead-end channels, flooded submerged islands, and nontidal waters.

Interconnected channels which form the network of the Sacramento and San Joaquin Rivers and tributaries. They range in width from a mile in the vicinity of the rivers' convergence to less than a few hundred feet, and some carry fairly strong tidal currents and flow velocities. Among their habitat functions, they serve as migration corridors and nursery areas for resident and migratory fish.

Habitat values of the channels depend upon the exposure to tides, current velocities, location in the Delta, depth to the bottom, width of the water body, salinity and other physical and chemical characteristics of the water body.

Dead end channels are very important. Fisheries surveys of the Delta have shown that the stagnant or slow-flowing dead-end sloughs, oxbows, channels behind berm islands, and small embayments clearly were the most productive channel types for resident fishes (DFG, 1987). They provide habitat for most of the principle resident fish species of the Delta (Madrone, 1980). These include white catfish, brown bullhead, black crappie, largemouth bass, and threadfin shad. All of these except for threadfin shad are taken by recreational anglers within these sloughs.

The greatest threat to the resident fish of the dead-end sloughs is the reduction of food supply if water transport systems change flow rates and distribution of plankters in the channels (Turner, 1972 in Madrone, 1980).

These areas also have intermediate to high levels of riparian or aquatic vegetation.

There are many lakes and ponds throughout the Delta. Some lakes with riparian vegetation, like Beach and Stone lakes near Sacramento, also support large numbers of waterfowl.

Blowout ponds are found at some of the reclamation districts. These ponds are formed when a levee breaks. The pressure of the water going through the hole actually causes soil at the exit point to be excavated. When the reclamation district is reclaimed, a lake is left which typically is about one or two acres in size. The depths of the lakes vary, but can be 40 feet or greater. They are found at Sherman Island, Webb Tract, Holland Tract, Bradford Island, and other Delta reclamation districts or locations.

Wildlife and fisheries values of blowout ponds are largely undocumented. However, the perimeter of the ponds tends to be lined with trees and shrubs, and considerable wildlife value is expected.

Sewage oxidation ponds should also be recognized for their habitat values. The sewage treatment ponds in Stockton, Lodi, and Clifton Court Forebay, support simple invertebrate communities, which include such animals as opossum shrimp and crayfish. These ponds are

heavily used during migration and winter months by shorebirds and waterfowl.

Shoals are shallow water areas, typically less than six feet in depth. These may or may not be associated with levees. These are often colonized by various species of bulrushes. The width of the shoals varies from perhaps ten feet to as much as 40-50 feet, and sometimes more. Some are remnants of the original islands, left in place in front of the levees following construction by the dredges. Some of these protective tule berms are gradually disappearing, primarily from repeated dredging and subsequent erosion, leaving the levees... throughout the Delta exposed to direct attack from tidal and flood currents and from wind- and boat-generated waves. Others have expanded as sediments are deposited.

The value of channels and open waters as fisheries habitat is generally greater when there are extensive shoals present (waters less than 10 feet deep) and when there is abundant vegetation at the land/water interface. Various fish species have water depth requirements. Many of the members of the sunfish family, including bluegill and black crappie, have been documented as using shallow waters for spawning. For example, Moyle (1976) reported that white crappie (*Pomoxis annularis*) nest in water usually less than three feet deep, underneath or close to overhanging bushes or banks. Striped bass catches have been found to be greatest in areas where water was four to ten feet deep (Sasaki, 1966).

## VII. NATURAL RESOURCES AREAS WITH SIGNIFICANT HABITAT VALUES

These areas have been defined by exhibiting high values for fish and wildlife. They are listed in Appendix A. These could become candidates for acquisition as State or Federal parks, preserves, reserves, or wildlife management areas. Locations in the Delta which have these areas have been identified and mapped in previous planning studies (DAPC, 1976; Madrone, 1980).

Many of these areas are valuable from a scenic, recreational, or historic perspective. Size and uniqueness were factors used in developing this list. SB 34 personnel conducted field evaluations in 1995 of these areas to determine their current status. Areas which no longer had significant values were deleted, and new areas added. These areas should be preserved to perpetuate the public trust.

All undeveloped non-leveed channel islands throughout the Delta are included within this classification. Only some of the largest of these are identified in Appendix A. This does not necessarily imply public ownership but only serves to identify all non-leveed islands as areas of significant natural resources.





## VIII. DELTA SOILS CHARACTERISTICS

The Delta is valued for its soils. This is especially true of the rich organic peat soils used for farming. And, most soils of the Delta are comprised mainly of peat, with some silts and clays and sand lenses. This is especially true of the central and western Delta. The average depth of peat is about 10 feet. Around the periphery of the Delta, alluvial deposits have resulted in a much higher mineral composition of the soils.

Delta soils were formed in geologic times. Unlike most other Deltas, the Sacramento-San Joaquin Delta narrows before reaching the sea (USFWS, 1989). One important consequence of the Delta's narrow mouth has been that the deposition of sediments has taken place mostly within the Delta, instead of forming spits or mudflats in San Francisco Bay.

The accumulation of sediments and dense growths of emergent plants produced, over long periods of time, organic soils. These soils were comprised of a high concentration of peat. They are waterlogged in their natural state, and if permitted to dry, tend to shrink and become easily compressible (Herbold and Moyle, 1989). Peat soils burn, and once ignited, are hard to extinguish.

Peat soils are thickest in the western and central portions of the Delta, where they reach a maximum depth of more than 50 feet at Sherman and Andrus Islands. Mineral soils, comprised of sand and silt, occur along the margins of the Delta and as channel and natural levee deposits. The physical and chemical properties of the organic soils make them susceptible to oxidation, aerobic decomposition, wind erosion, and fire. These properties create continual subsidence problems. The process of subsidence involves a lowering of the land surface elevation. Peat areas of most islands subside at average rates of from one to three inches per year (DWR, 1980, as reported in SLC, 1991). Over 90 percent of the shallow subsidence of the organic soils is due to oxidation and microbial decomposition. Before reclamation, the surface elevation of organic soils in the Delta was about sea level. The magnitude of negative elevations (that is, elevations below sea level based on 1978 topography) is an approximate measure of the maximum amount of subsidence that has taken place on each Delta island since initial reclamation. Available data indicates that most Delta subsidence is shallow and related to depletion of the organic soils rather than deep-seated regional subsidence.



## IX. WATER QUALITY

There are several relevant parameters of Delta water quality. These include salinity, dissolved oxygen (DO) concentrations, turbidity, presence of toxic substances, and other factors. These are governed by many factors, including seasonal and annual fluctuations in water temperatures, water inflow and outflow, and land uses within the watersheds. In turn, these factors play a large role in determining fish and wildlife populations. Delta water quality is primarily influenced by the Sacramento River via the cross channel, and under certain conditions, return flow around Sherman Island (Montoya, 1991).

Tidal mixing keeps Delta waters generally turbid throughout the year, with water visibility frequently less than two feet. Turbidity increases during the winter and spring, when sediment laden waters enter the Delta (Madrone, 1980).

Dissolved oxygen (DO) concentrations in the Delta must be maintained to support aquatic life. Among fish species which require the highest DO concentrations are the threadfin shad and chinook salmon. DO concentrations in the Delta varies with local conditions. DO is decreased by such factors as low flows, high temperatures, municipal and agricultural discharges, and by dredging activities. It can be increased by aquatic plants and algae. Low DO concentrations are a potential problem in Delta waters with impaired water circulation. These waters include Beaver, Sycamore, and Hog Sloughs, and other waterways which are open at only one end.

Most of the native and introduced fish species of the Delta are adapted to a strictly freshwater existence. Some, such as the Delta smelt, white sturgeon, or splittail, either tolerate or require salt or brackish water. Fresh water must be provided in the Delta to maintain these populations, including flows necessary to prevent the null zone (discussed in "Water Systems") from entering the western Delta and salt water intrusion from occurring. The amount of freshwater which goes through the Delta has been mandated by State and Federal law.

Toxics create a water quality problem. There are various measures of toxicity. Toxics found in the Delta include various pesticides and inorganic metallic elements. Areas which have high concentrations of pollutants, including heavy metals or organic compounds, are considered "toxic hot spots" as defined under the State Water Code and have been found in the Delta.

Pollutant sources within the legal boundaries of the Delta include 260 agricultural drainage pumps (DWR, 1990, in Montoya, 1991), 10 major cities encompassing about 35,000 acres of urban land, and about 99 boat marinas (Montoya, 1991). Major pollutant sources outside the Delta boundaries are similar but also include inactive mine drainage, such as from the Penn Mine in the Mokelumne River watershed. Mine drainage contributes cadmium, copper, and chromium to the lower Sacramento River and the Delta (SLC, 1991).

Pesticides in some cases adversely impact Delta water quality. Laboratory procedures are now advanced enough to detect extremely small concentrations. This has allowed regulators,

like the RWQCB, to change their emphasis to non-point source pollution, which comes from parking lots and farm fields. Diazinon and chlorpyrifos are pesticides which have recently been identified as potential water quality hazards in the Delta. Very low concentrations of diazinon have been lethal to water fleas, organisms similar in sensitivity to the opossum shrimp of the Delta. This has given rise to concerns that the opossum shrimp, as well as other items at the base of the Delta food chain, may be at risk. Other pesticides have caused problems. Rice herbicides and other pollutants have been suggested as a contributing factor to the decline of striped bass (SLC, 1991).

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**APPENDIX A**

**NATURAL RESOURCE AREAS  
WITH SIGNIFICANT HABITAT VALUES**

## Appendix A

### Natural Resource Areas with Significant Habitat Values

Map Symbol	Significant Area	Description of Area
1	Van Sickle, Chipps, and Wheeler Islands	This area consists of marshlands. Three special status species found along waterside of levees.
2	Salt marsh west of Pittsburg	Marshland. Habitat for salt-marsh harvest mouse and California black rail.
3	Browns and Winter Islands	Browns Island is an upland area with blue heron rookery. Approximately 400 acres of marsh habitat and three special status plants on Winter Island.
4	Antioch-Pittsburg Marsh	Large marsh area; open space between industrial developments.
5	Antioch Sand Dunes	A unique community, remnant of the once extensive Antioch Dunes. Habitat for two endangered plants and one butterfly.
6	Big Break	Emergent marsh. Tract flooded in 1930's. Good fish habitat. Surveys in early 1980's revealed presence of California black rails.
7	Little Franks Tract	Flooded island with a freshwater marsh. Nature study area. Black-crowned night heron rookery in riparian scrub-shrub along levee.
8	Franks Tract	Flooded island of 3,507 acres. Spawning habitat for Delta smelt. Three special status plants found on remnant levee as well.
9	Sand Mound Slough	Good examples of tule islands. Scenic slough. Black rails present on tule islands.
10	Connection Slough, Rhode Island, Old River Complex	A diverse mix of upland habitat, riparian trees and shrub-scrub, marsh, and tule islands. Excellent wildlife habitat, particularly for raptors, songbirds, and game species. Habitat for special status plants, California black rail, and yellow-breasted chat.
11	Middle River	Channel tule islands. Well-developed riparian habitat, extending beyond levees in a few places. Habitat for California black rail, yellow-breasted chat, and special status plants.

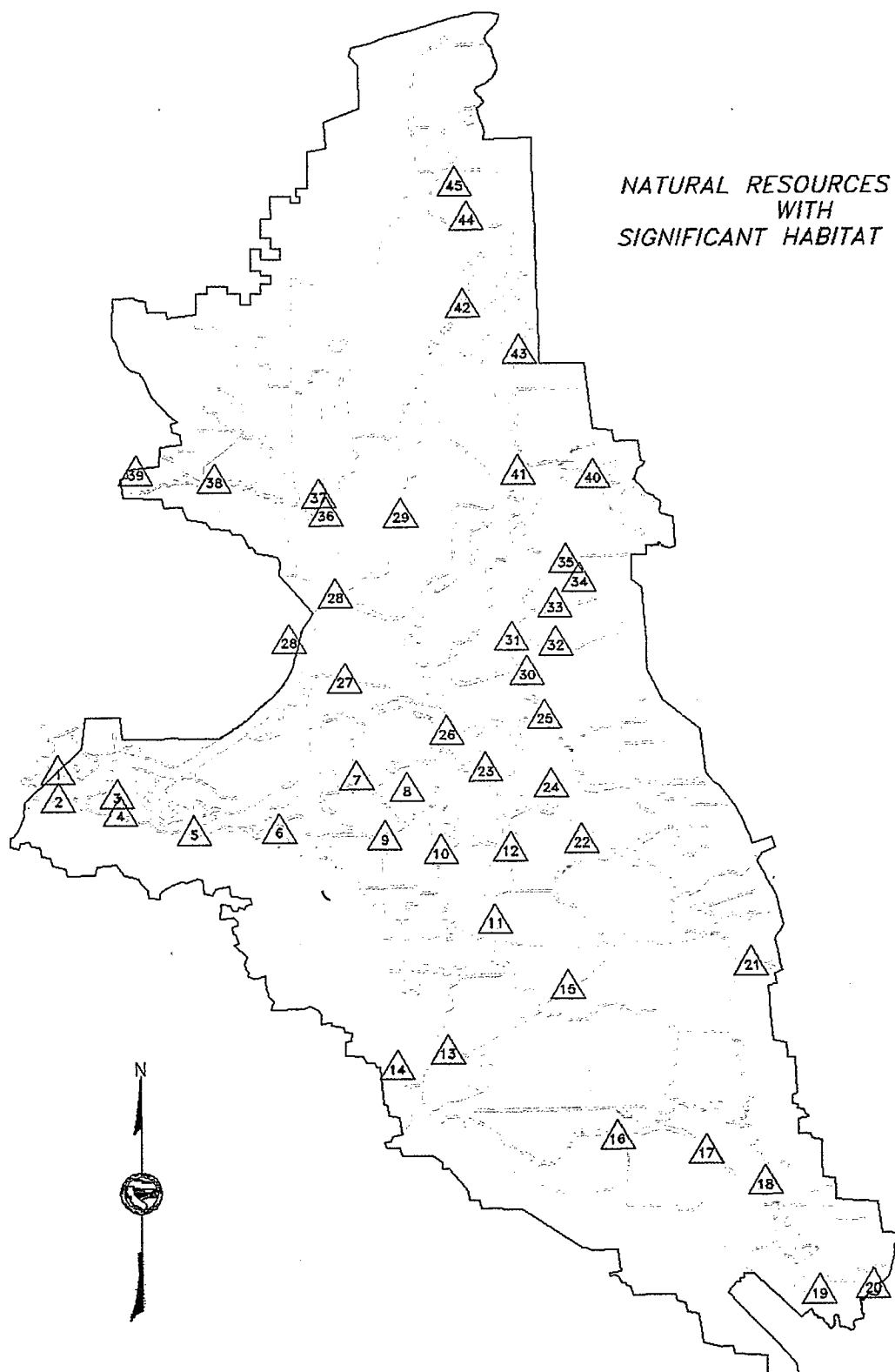
- |    |                                                                                  |                                                                                                                                                                                                                                                                                                    |
|----|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12 | Latham Slough                                                                    | Channel tule islands, as well as some with riparian shrub-scrub and woodland. Shrub-scrub riparian habitat along levees.                                                                                                                                                                           |
| 13 | Eucalyptus and Widdows Island                                                    | Upland habitat on Eucalyptus Island. Widdows Island is a flooded island.                                                                                                                                                                                                                           |
| 14 | Byron Alkali Vernal Pools                                                        | 250-acre site supporting unique flora adapted to vernal pools that collect in alkaline soils.                                                                                                                                                                                                      |
| 15 | Trapper Slough                                                                   | Closed-off channel, now a freshwater marsh with a lush growth of tules. Supports much wildlife and a highly productive fishery.                                                                                                                                                                    |
| 16 | Old River, Lower Tom Paine and Salmon Sloughs, and Doughty and Crocker Cut area. | Along south reaches of Old River. Upland islands; well-developed oak riparian along steep, unriprapped banks; oak savannah remnants in places. Deep mineral soils; very different from riparian elsewhere in Delta. Numerous Swainson's hawk nests.                                                |
| 17 | Paradise Cut                                                                     | Western end with mature oak riparian woodland. Cottonwood riparian in middle stretch, to Paradise Road. To the east, levees lined with riparian shrub-scrub, flanked by walnut orchard. Numerous Swainson's hawk nests.                                                                            |
| 18 | Circle Lake                                                                      | Oxbow lake. Fish spawning area.                                                                                                                                                                                                                                                                    |
| 19 | South County Park                                                                | Riparian habitat. Swainson's hawk nesting in park.                                                                                                                                                                                                                                                 |
| 20 | Caswell Memorial Park                                                            | Riparian forest. Blue heron rookery. Home of riparian brush rabbit and riparian woodrat. Habitat for Swainson's hawk.                                                                                                                                                                              |
| 21 | French Camp Slough                                                               | Mature riparian habitat. Swainson's hawk nest.                                                                                                                                                                                                                                                     |
| 22 | Stockton Deepwater Channel Islands                                               | Hog and Spud Islands. Upland habitat; oaks; freshwater marsh.                                                                                                                                                                                                                                      |
| 23 | Venice Cut and Mandeville Tip Area                                               | Large islands with extensive riparian vegetation and tule marsh. Habitat for a wide variety of birds.                                                                                                                                                                                              |
| 24 | Disappointment Slough and Stockton Deepwater Channel Islands                     | Includes tidal islands in Disappointment Slough, diverse mixture of upland and marsh habitats on Lost Lake Tule, Headreach, Tinsley Islands. Young riparian trees. Freshwater marsh with open water, valuable to wintering ducks. Also habitat for California black rail and yellow-breasted chat. |
| 25 | White Slough and Marsh, Potato Slough and Little Potato Slough                   | Channel tule islands; freshwater marsh; some riparian habitat; very scenic. California black rail, giant garter snake, and four special status plant species found here.                                                                                                                           |

- |    |                                                                               |                                                                                                                                                                                                                                                       |
|----|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 26 | Potato Point                                                                  | 100 acres of original Delta backswamp vegetation. Willows, giant reed, beaver ponds, freshwater marsh; extensive raptor, songbird and waterfowl use.                                                                                                  |
| 27 | Seven Mile Slough                                                             | Riparian trees and shrub-scrub along a little-used slough.                                                                                                                                                                                            |
| 28 | Sand Dunes, Anthicid Beetle Habitat                                           | Sandy areas on Grand Island and near Rio Vista have been proposed as critical habitat for the Sacramento and Antioch Dunes anthicid beetles.                                                                                                          |
| 29 | Steamboat Slough                                                              | Some riparian shrub-scrub, SRA, and woodland at south end, near Howard Landing, and along northern section.                                                                                                                                           |
| 30 | Island, South Fork Mokelumne River between Staten Island and Terminous Tract. | Some higher ground in center. Diverse vegetation. May be remnant example of an original Delta vegetational community.                                                                                                                                 |
| 31 | Sycamore Island                                                               | Island at mouth of Sycamore Slough. Woody vegetation with some surrounding marsh vegetation. Large black-crowned night heron rookery.                                                                                                                 |
| 32 | Sycamore Slough                                                               | One of 3 major dead-end sloughs. Tule islands in channel; some sparse riparian vegetation on levees.                                                                                                                                                  |
| 33 | Hog Slough                                                                    | One of 3 major dead-end sloughs, with unique aquatic characteristics. Seasonal marsh at head of slough.                                                                                                                                               |
| 34 | Blossom Slough                                                                | Large willows and cottonwoods; slough lined with tules. Both ends closed; private and protected from recreational use. Valuable bird habitat. Habitat for giant garter snake.                                                                         |
| 35 | Beaver Slough                                                                 | The northernmost of the 3 major dead-end sloughs, with the most extensive riparian vegetation. East of Blossom Road, some well-developed trees; many snags in water. East end inaccessible to all but small, slow boats, preserving wildlife habitat. |
| 36 | Minor Slough                                                                  | Shrub-scrub areas along north end; riparian trees providing much shaded riverine aquatic habitat along south end.                                                                                                                                     |
| 37 | Prospect Slough                                                               | Upland and riparian habitat. Impressive open water vista.                                                                                                                                                                                             |
| 38 | Lindsey Slough                                                                | Black-crowned night heron rookery and heavy use by raptors. Geologically interesting; formed as an historic drainage of the Yolo Basin. Emergent marshes.                                                                                             |

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|----|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 39 | Vernal pools west of Hastings Tract (Jepson Prairie Preserve) | Unique complex of vernal pools, remnant native bunch-grass communities. Ecological values of Statewide significance. Vernal pools support many unique plants, including Solano and Colusa grass, and fairy shrimp. Also, only place where Delta green ground beetle is found.                                                         |
| 40 | Mokelumne and Cosumnes River Complex                          | Area of heavily shaded riverine aquatic habitat. Riparian trees and elderberry plants. Several nesting Swainson's hawks. Sandhill crane wintering habitat.                                                                                                                                                                            |
| 41 | Delta Meadows and Snodgrass Slough                            | Marsh, riparian, and upland habitat; many oaks, wooded islands. Ecologically tied to Stone Lake Basin. Invaluable ecological area.                                                                                                                                                                                                    |
| 42 | Elk Slough                                                    | Mature riparian woodland along levees. Slough full of snags, fallen trees; good aquatic habitat for bass and other species.                                                                                                                                                                                                           |
| 43 | Stone Lake Complex                                            | Old overflow basins, with diversity of habitat types: lakes, freshwater marshes, riparian trees and shrubs, grassland, quiet sloughs. Specialized habitat for giant garter snake. Great blue heron and egret rookeries. Removed from summertime recreational activities. One of the most important ecological complexes in the Delta. |
| 44 | Winchester Lake                                               | Expanse of open water; scattered trees on bank at western end of lake. Eastern end with more bank vegetation, more aquatic vegetation in lake, and more wildlife value than western section.                                                                                                                                          |
| 45 | Babel Slough                                                  | Narrow strip of riparian trees, shrub-scrub, occasionally on both sides of slough. Some dead snags offer hole-nesting opportunities. Not extensive, but valuable wildlife habitat.                                                                                                                                                    |



*NATURAL RESOURCES AREAS  
WITH  
SIGNIFICANT HABITAT VALUES*



A-5

**APPENDIX B**

**FLORA OF THE  
SACRAMENTO-SAN JOAQUIN DELTA**

SIMAROUBACEAE (QUASSIA or SIMAROUBA FAMILY)

Tree of heaven	Disturbed urban areas, waste places	Common
* <i>Ailanthus altissima</i>		

SOLANACEAE (NIGHTSHADE FAMILY)

Jimson weed	Sandy soils, open, often disturbed areas	Common
* <i>Datura stramonium</i>		
Tomato	Waste areas, abandoned fields, roadsides	Uncommon
* <i>Lycopersicon esculentum</i>		
Tree tobacco	Open, disturbed flats or slopes	Common
* <i>Nicotiana glauca</i>		
Tobacco	Open, well drained washes, slopes	Uncommon
<i>Nicotiana quadrivalvis</i>		
White nightshade	Open, often disturbed places	Common
<i>Solanum americanum</i>		
Black nightshade	Disturbed places	Common
* <i>Solanum nigrum</i>		

TAMARICACEAE (TAMARISK FAMILY)

Salt cedar	Washes, slopes, sand dunes, roadsides	Uncommon
* <i>Tamarix parviflora</i>		

ULMACEAE (ELM FAMILY)

Hackberry	Canyons, seeps, washes (Escape)	Uncommon
* <i>Celtis occidentalis</i>		
English elm	Waste places, canyons (Cultivated)	Uncommon
* <i>Ulmus minor</i>		
Chinese elm	Waste places, roadsides, washes (Cultivated)	Uncommon
* <i>Ulmus parvifolia</i>		

URTICACEAE (NETTLE FAMILY)

Hoary nettle	Streambanks, margins of deciduous woodlands, moist, waste places	Common
<i>Urtica dioica</i> ssp. <i>holosericea</i>		
Dwarf nettle	Waste areas, gardens, orchards	Common
* <i>Urtica urens</i>		

VERBENACEAE (VERVAIN FAMILY)

Lippia	Wet places, ditches, fields	Common
<i>Phyla nodiflora</i> var. <i>nodiflora</i>		
Verbena	Disturbed, often wet places, fields, roadsides	Common
* <i>Verbena bonariensis</i>		
Verbena	Wet places, ditches, marshes	Common
<i>Verbena hastata</i>		
Verbena	Disturbed places, fields	Common
* <i>Verbena littoralis</i>		

VISCACEAE (MISTLETOE FAMILY)

Big leaf mistletoe	On woody dicots other than Quercus	Common
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\*non-native plants of California

## Appendix B

### F L O R A

#### Plants Observed as Part of S.B. 34 Sacramento-San Joaquin Delta Habitat Studies

Modified from JOHN R. ARNOLD AND CHRIS KJELDSSEN (1990-94) and BARRY BABA (1993-1995), DELTA HABITAT STUDIES. Agricultural and other cultivated plants are not included in this list. Nomenclature and habitat descriptions follow Hickman, 1993.

<u>COMMON AND</u> <u>SCIENTIFIC NAMES</u>	<u>HABITAT</u>	<u>ABUNDANCE</u> <u>IN DELTA</u>
<b>NONFLOWERING PLANTS: PTERIDOPHYTES</b>		
<b><u>AZOLLACEAE</u> (MOSQUITO FERN FAMILY)</b>		
Duckweed fern <i>Azolla filiculoides</i>	Ponds, slow streams, wet ditches	Common
<b><u>DENNSTAEDTIACEAE</u> (BRACKEN FAMILY)</b>		
Bracken fern <i>Pteridium aquilinum</i> var. <i>pubescens</i>	Moist areas, partial to full sun	Uncommon
<b><u>DRYOPTERIDACEAE</u> (WOOD FERN FAMILY)</b>		
Lady fern <i>Athyrium filix-femina</i> var. <i>cyclosorum</i>	Channel islands, along streams, seepage areas	Uncommon
<b><u>EQUISETACEAE</u> (HORSETAIL FAMILY)</b>		
Common horsetail <i>Equisetum arvense</i>	Moist, disturbed areas	Common
Horsetail <i>Equisetum hyemale</i> ssp. <i>affine</i>	Streams, moist, sandy or gravelly areas	Common
Smooth scouring rush <i>Equisetum laevigatum</i>	Moist, sandy, or gravelly areas	Uncommon
<b><u>MARSILEACEAE</u> (MARSILEA FAMILY)</b>		
Clover fern <i>Marsilea vestita</i> ssp. <i>vestita</i>	Creek beds, flood basins, vernal pools, etc.	Rare
Pillwort <i>Pilularia americana</i>	Vernal pools, mud flats, lake margins, reservoirs, etc.	Probably extirpated

## FLOWERING PLANTS: DICOTYLEDONS

### ACERACEAE (MAPLE FAMILY)

\*non-native plants of California

B-1

Box elder <i>Acer negundo</i> var. <i>californicum</i>	Streamsides, bottomlands	Common
<b><u>AIZOACEAE</u> (FIG-MARIGOLD FAMILY)</b>		
Hottentot fig-ice plant * <i>Carpobrotus edulis</i>	Usually coastal habitats, especially on sand	Common
<b><u>AMARANTHACEAE</u> (AMARANTH FAMILY)</b>		
Tumbleweed * <i>Amaranthus albus</i>	Waste places, roadsides, fields	Common
Pigweed <i>Amaranthus blitoides</i>	Waste places	Uncommon
Pigweed * <i>Amaranthus hybridus</i>	Disturbed places	Common
Pigweed <i>Amaranthus powellii</i>	Waste places	Uncommon
Rough or redroot pigweed * <i>Amaranthus retroflexus</i>	Wet fields, roadsides, ditches, waste places	Common
Spiney amaranthus * <i>Amaranthus spinosus</i>	Roadsides, waste places	Uncommon
<b><u>ANACARDIACEAE</u> (SUMAC or CASHEW FAMILY)</b>		
Peruvian pepper tree * <i>Shinus molle</i>	Washes, slopes, abandoned fields	Uncommon
Poison oak <i>Toxicodendron diversilobum</i>	Canyons, slopes, chaparral, oak woodlands	Common
<b><u>APIACEAE</u> [Umbelliferae] (CARROT FAMILY)</b>		
Celery * <i>Apium graveolens</i>	Wet places	Uncommon
Water hemlock <i>Cicuta douglasii</i>	Wet places, often in water	Uncommon
Poison hemlock * <i>Conium maculatum</i>	Moist places, usually disturbed areas	Common
Carrot * <i>Daucus carota</i>	Roadsides, disturbed places	Common
Bee thistle <i>Eryngium articulatum</i>	Lake and stream margins, marshes	Rare
Fennel * <i>Foeniculum vulgare</i>	Roadsides, waste places	Abundant
Cow parsnip <i>Heracleum lanatum</i>	Moist places, wooded or open	Uncommon
Floating ranunculus-leaved pennywort <i>Hydrocotyle ranunculoides</i>	Lake margins, pools, etc.	Uncommon
Pennywort <i>Hydrocotyle umbellata</i>	Stream banks, marshy areas	Uncommon
Marsh pennywort <i>Hydrocotyle verticillata</i>	Swampy ground, lake margins	Common

\*non-native plants of California

<sup>1</sup> Mason's lilaeopsis <i>Lilaeopsis masonii</i>	Intertidal marshes, streambanks	Common
Alkali parsnip <i>Lomatium caruifolium</i>	Adobe of wet places, vernal pools, open grasslands	Uncommon
Oenanthe <i>Oenanthe sarmentosa</i>	Streams, marshes, ponds, often aquatic	Uncommon
Wild parsnip <i>*Pastinaca sativa</i>	Roadsides, etc.	Common
<b><u>APOCYNACEAE</u> (DOGBANE FAMILY)</b>		
Indian hemp <i>Apocynum cannabinum</i>	Moist places near streams, etc., or weed in orchards	Common
Perwinkle <i>*Vinca major</i>	Sheltered places, especially along streams	Common
<b><u>ARALIACEAE</u> (GINSENG FAMILY)</b>		
English ivy <i>*Hedera helix</i>	Disturbed areas (Cultivated escape)	Common
<b><u>ASCLEPIADACEAE</u> (MILKWEED FAMILY)</b>		
Milkweed <i>Asclepias</i> spp.	Many habitats	Uncommon
<b><u>ASTERACEAE</u> [Compositae] (SUNFLOWER FAMILY)</b>		
Yarrow <i>Achillea millefolium</i>	Many habitats	Common
Russian knapweed <i>*Acroptilon repens</i>	Fields, roadsides, cultivated grounds	Common
Common ragweed <i>*Ambrosia artemisiifolia</i>	Disturbed sites	Common
Western ragweed <i>Ambrosia psilostachya</i>	Roadsides, dry fields	Common
Pearly everlasting <i>Anaphalis margaritacea</i>	Woods, roadsides, disturbed places	Common
Mayweed, Stinkweed, Dog fennel <i>*Anthemis cotula</i>	Disturbed areas, chaparral, roadsides, coastal dunes	Common
Common burdock <i>*Arctium minus</i>	Disturbed places	Common
Mugwort, Wormwood <i>Artemisia douglasiana</i>	Open to shady places, often in drainages	Abundant
Tarragon <i>Artemisia dracunculus</i>	Meadows, disturbed sites	Common
Silver wormwood <i>Artemisia ludoviciana</i> ssp. <i>ludoviciana</i>	Generally dry, sandy to rocky soils	Common
Aster <i>Aster chilensis</i>	Grasslands, marshes, disturbed places	Uncommon

<sup>1</sup>Mason's lilaeopsis (*Lilaeopsis masonii*) is listed as a Rare species by the CDFG, Category 2 Candidate species by the USFWS, and a List 1B plant by the CNPS.

\*non-native plants of California

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<sup>2</sup> Suisun marsh aster <i>Aster lentus</i>	Tidal streams in marsh areas	Common
Aster <i>Aster subulatus</i> var. <i>ligulatus</i>	Wet places, often alkaline	Common
Marsh baccharis <i>Baccharis douglasii</i>	Moist salt marshes, stream edges	Common
Chaparral broom, Coyote brush <i>Baccharis pilularis</i>	Coastal bluffs to oak woodland	Common
Mule fat, Seep-willow, Water-wally <i>Baccharis salicifolia</i>	Canyon bottoms, irrigation ditches, moist streamsides	Common
Balsam root, Sunflower <i>Balsamorhiza macrolepis</i>	Dry slopes, valleys	Common
Sticktight <i>Bidens frondosa</i>	Damp soil, especially disturbed sites	Common
Bur-marigold <i>Bidens laevis</i>	Freshwater wetlands	Common
Italian thistle * <i>Carduus pycnocephalus</i>	Roadsides, pastures, waste areas	Uncommon
Safflower * <i>Carthamus tinctorius</i>	Disturbed places, roadsides	Common
Bachelor's button, Cornflower * <i>Centaurea cyanus</i>	Disturbed grasslands, open woods	Common
Yellow star thistle * <i>Centaurea solstitialis</i>	Disturbed areas, pastures, roadsides	Abundant
Pineapple weed, Rayless chamomile * <i>Chamomilla suaveolens</i>	Disturbed sites, sand bars, river banks, footpaths, roadsides	Common
Needle-leaved rabbit brush <i>Chrysothamnus teretifolius</i>	Rocky flats, slopes	Common
Chicory * <i>Cichorium intybus</i>	Roadsides, waste places	Common
Bull thistle * <i>Cirsium vulgare</i>	Disturbed areas	Common
Horseweed <i>Conyza canadensis</i>	Waste ground	Abundant
Calliopsis * <i>Coreopsis tinctoria</i>	Disturbed places	Common
Brass-button * <i>Cotula coronopifolia</i>	Saline and freshwater marshes along coast	Uncommon
Cardoon, Artichoke thistle * <i>Cynara cardunculus</i>	Disturbed places	Common
Artichoke * <i>Cynara scolymus</i>	Disturbed places	Common
Eclipta <i>Eclipta prostrata</i>	Damp places	Common
Annual fleabane * <i>Erigeron annuus</i>	Disturbed places	Common

<sup>2</sup>The Suisun marsh aster (*Aster lentus*) is currently designated as a Category 2 Candidate species by the USFWS and a List 1B plant by the CNPS.

\*non-native plants of California

B-4

Western goldenrod <i>Euthamia occidentalis</i>	Ditches, marshes, streambanks, meadows	Common
Everlasting cudweed * <i>Gnaphalium luteo-album</i>	Fields, waste places	Uncommon
Cudweed <i>Gnaphalium stramineum</i>	Moist, disturbed places	Common
Gum plant <i>Grindelia camporum</i>	Fields, sandy or saline bottomlands, roadsides	Common
Bitter sneezeweed * <i>Helenium amarum</i>	Disturbed areas	Common
Sneezeweed, Rosilla <i>Helenium puberulum</i>	Streamsides, marshes, other wetlands	Common
Sunflower <i>Helianthus annuus</i>	Disturbed areas, shrubland, many other habitats	Common
Spikeweed <i>Hemizonia fitchii</i>	Fields, open woodland	Uncommon
Pappose spikeweed <i>Hemizonia parryi</i> ssp. <i>rudis</i>	Grassy areas	Common
Spikeweed <i>Hemizonia pungens</i>	Grasslands, depressions, marshes	Common
Telegraph weed <i>Heterotheca grandiflora</i>	Disturbed areas, dry streams, sand dunes	Common
Smooth cat's-ear * <i>Hypochaeris glabra</i>	Disturbed places	Common
Fleshy jaumea <i>Jaumea carnosa</i>	Coastal salt marshes, bases of sea cliffs	Uncommon
Prickly lettuce * <i>Lactuca serriola</i>	Disturbed places	Common
Bristly ox-tongue * <i>Picris echioides</i>	Waste places	Common
Salt marsh fleabane <i>Pluchea odorata</i>	Moist, often saline valley bottoms	Uncommon
Shrubby butterweed <i>Senecio flaccidus</i> var. <i>douglasii</i>	Dry, rocky, or sandy sites	Uncommon
Common groundsel * <i>Senecio vulgaris</i>	Gardens, farmlands, other disturbed sites	Common
Milk thistle * <i>Silybum marianum</i>	Roadsides, pastures, waste areas	Common
Prickly sow thistle * <i>Sonchus asper</i> ssp. <i>asper</i>	Slightly moist places, gardens, along streams	Common
Common sow thistle * <i>Sonchus oleraceus</i>	Weed in waste places, gardens, etc.	Common
Dandelion * <i>Taraxacum officinale</i>	Lawn weed, meadows	Common
Salsify, Oyster plant * <i>Tragopogon porrifolius</i>	Waste places	Common
Spiny cocklebur <i>Xanthium spinosum</i>	Disturbed areas	Common

\*non-native plants of California

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Cocklebur <i>Xanthium strumarium</i>	Disturbed areas	Common
<b>BETULACEAE (BIRCH FAMILY)</b>		
White alder <i>Alnus rhombifolia</i>	Streamsides	Common
<b>BORAGINACEAE (BORAGE FAMILY)</b>		
Rancher's fireweed <i>Amsinckia menziesii</i> var. <i>intermedia</i>	Open, generally disturbed places	Common
Chinese pusley, Salt heliotrope <i>Heliotropium curassavicum</i>	Moist to dry, saline soils	Common
Annual heliotrope <i>*Heliotropium europaeum</i>	Open, often disturbed sites, fields	Common
<b>BRASSICACEAE [Cruciferae] (MUSTARD FAMILY)</b>		
Black mustard <i>*Brassica nigra</i>	Fields, disturbed areas	Common
Turnip, Field mustard <i>*Brassica rapa</i>	Grainfields, orchards, disturbed areas	Common
Tournefort mustard <i>*Brassica tournefortii</i>	Roadsides, washes, open areas	Common
Shepherd's purse <i>*Capsella bursa-pastoris</i>	Disturbed sites, gardens	Common
Wart cress, Swine cress <i>*Coronopus didymus</i>	Disturbed areas, gardens, fields	Uncommon
Mustard <i>*Hirschfeldia incana</i>	Roadsides, creek bottoms, disturbed areas	Abundant
Perennial peppergrass <i>*Lepidium latifolium</i>	Beaches, tidal shores, saline soils, roadsides	Common
Peppergrass <i>Lepidium virginicum</i> var. <i>pubescens</i>	Disturbed areas, abandoned fields, meadows, roadsides	Common
Wild radish <i>*Raphanus sativus</i>	Disturbed places, fields, roadsides	Abundant
Water cress <i>Rorippa nasturtium-aquaticum</i>	Streams, springs, marshes, lake margins	Common
Water cress <i>Rorippa palustris</i> var. <i>occidentalis</i>	Streambeds, sand bars, wet depressions	Common
Hedge mustard <i>*Sisymbrium officinale</i>	Disturbed areas, gardens, roadsides	Common
Penny-cress, Fan-weed <i>*Thlaspi arvense</i>	Disturbed areas, fields, roadsides	Common
<b>CALLITRICHACEAE (WATER-STARWORT FAMILY)</b>		
Water-starwort <i>Callitriche hermaphroditica</i>	Submerged in quiet streams, ponds	Uncommon

\*non-native plants of California

CALYCANTHACEAE (SWEET-SHRUB or CALYCANTHUS FAMILY)

Spicebush, Sweet shrub <i>Calycanthus occidentalis</i>	Moist, shady places, canyons, streamsides	Uncommon
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CAPRIFOLIACEAE (HONEYSUCKLE FAMILY)

Honeysuckle <i>Lonicera</i> sp.	Streambanks, moist places	Uncommon
Twinberry <i>Lonicera involucrata</i>	Moist places	Uncommon
Blue elderberry <i>Sambucus mexicana</i>	Streambanks, open places in forest	Common

CARYOPHYLLACEAE (PINK FAMILY)

Mouse-ear chickweed * <i>Cerastium fontanum</i> ssp. <i>vulgare</i>	Disturbed areas, grassy slopes, marshy ground	Common
Catchfly <i>Silene antirrhina</i>	Open areas, burns	Common
Campion * <i>Silene gallica</i>	Fields, disturbed areas	Common
Stickwort, Starwort * <i>Spergula arvensis</i> ssp. <i>arvensis</i>	Open slopes, pine woods, sand dunes, disturbed areas	Common
Sand-spurrey * <i>Spergularia bocconii</i>	Salt marshes, alkaline areas, sandy soils	Uncommon
Sand-spurrey <i>Spergularia marina</i>	Mud flats, alkaline fields, sandy areas, salt marshes	Common
Common chickweed * <i>Stellaria media</i>	Oak woodlands, meadows, disturbed areas	Common

CERATOPHYLLACEAE (HORNWORT FAMILY)

Hornwort <i>Ceratophyllum demersum</i>	Ponds, ditches, slow streams	Abundant
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CHENOPODIACEAE (GOOSEFOOT FAMILY)

Iodine bush <i>Allenrolfea occidentalis</i>	Saline soils, flats, bluffs	Uncommon
Saltbush <i>Atriplex coronata</i>	Alkaline soils	Uncommon
Saltbush <i>Atriplex fruticulosa</i>	Clay or alkaline soils, open sites, shrubland	Uncommon
Big saltbush <i>Atriplex lentiformis</i>	Alkaline or saline washes, dry lakes, shrubland	Uncommon
Australian saltbush * <i>Atriplex semibaccata</i>	Waste places, shrubland, woodland	Uncommon
Bractscale <i>Atriplex serenana</i>	Alkaline flats, coastal bluffs	Uncommon
Spear oracle, Fat-hen <i>Atriplex triangularis</i>	Generally saline soils	Common
Pigweed, Lamb's quarters * <i>Chenopodium album</i>	Disturbed places, fields, roadsides	Common

\*non-native plants of California

Mexican tea * <i>Chenopodium ambrosioides</i>	Disturbed places	Abundant
Pickleweed <i>Salicornia subterminalis</i>	Salt marshes, alkaline flats	Common
Pickleweed <i>Salicornia virginica</i>	Salt marshes, alkaline flats	Uncommon
Russian thistle, tumbleweed * <i>Salsola tragus</i>	Disturbed places	Common
Bush seepweed <i>Suaeda moquinii</i>	Alkaline and saline places, usually interior and desert	Uncommon
<b>CONVOLVULACEAE (MORNING-GLORY FAMILY)</b>		
Hedge bindweed <i>Calystegia sepium</i> ssp. <i>limnophila</i>	Marshes	Common
Bindweed, Orchard morning glory * <i>Convolvulus arvensis</i>	Orchards, gardens	Common
Alkali weed <i>Cressa truxillensis</i>	Saline and alkaline soils	Uncommon
<b>CORNACEAE (DOGWOOD FAMILY)</b>		
American dogwood <i>Cornus sericea</i> ssp. <i>sericea</i>	Many habitats, generally moist	Common
<b>CRASSULACEAE (STONECROP FAMILY)</b>		
Pigmy-weed <i>Crassula aquatica</i>	Salt marshes, vernal pools, ponds	Common
<b>CUCURBITACEAE (GOURD FAMILY)</b>		
Watermelon * <i>Citrullus colocynthis</i>	Disturbed areas (cultivated escape)	Common
Squash * <i>Cucurbita pepo</i> var. <i>melopepo</i>	Sandy places (cultivated escape)	Common
<b>CUSCUTACEAE (DODDER FAMILY)</b>		
Marsh dodder <i>Cuscuta subinclusa</i>	Generally on shrubs, in forests near streams, rivers	Uncommon
<b>DIPSACACEAE (TEASEL FAMILY)</b>		
Teasel * <i>Dipsacus sativus</i>	Disturbed areas, fields, vacant lots, old pastures	Common
<b>EUPHORBIACEAE (SPURGE FAMILY)</b>		
Spotted spurge * <i>Chamaesyce maculata</i>	Waste places, gardens	Common
Spurge <i>Chamaesyce ocellata</i>	Sandy soils	Rare
California croton <i>Croton californicus</i>	Sandy soils, dunes, washes	Common

\*non-native plants of California

Turkey mullein, Dove weed <i>Eremocarpus setigerus</i>	Dry, open, often disturbed areas	Common
<b>FABACEAE [Leguminosae] (PEA FAMILY)</b>		
Green wattle * <i>Acacia decurrens</i>	Disturbed, coastal, and urban areas?	Common
Blackwood acacia * <i>Acacia melanoxylon</i>	Disturbed areas	Common
Bird-of-Paradise * <i>Caesalpinia gilliesii</i>	Disturbed areas, urban and rural areas	Uncommon
Wild licorice <i>Glycyrrhiza lepidota</i>	Moist, generally open, disturbed sites	Uncommon
Hoita <i>Hoita macrostachya</i>	Streamsides, marshes, spring-moist places	Uncommon
Wild pea <i>Lathyrus jepsonii</i> var. <i>californicus</i>	Forests, open areas	Common
<sup>3</sup> Delta tule pea <i>Lathyrus jepsonii</i> var. <i>jepsonii</i>	Coastal and estuarine marshes	Common
Pea <i>Lathyrus vestitus</i>	Chaparral, oak woodland, coniferous or mixed forest	Uncommon
Birdfoot trefoil * <i>Lotus corniculatus</i>	Probably naturalized in open, disturbed areas	Common
Lotus <i>Lotus humistratus</i>	Grassland, oak and pine woodland, roadsides	Common
Spanish clover <i>Lotus purshianus</i> var. <i>purshianus</i>	Coast, chaparral, water courses, roadsides	Common
California broom <i>Lotus scoparius</i>	Chaparral, roadsides, coastal sand, flats, washes	Common
Lotus * <i>Lotus uliginosus</i>	Wet fields, roadsides, ditches	Common
Silver lupine <i>Lupinus albifrons</i>	Open sand or rocks	Rare
Annual lupine <i>Lupinus bicolor</i>	Open or disturbed areas	Rare
Medicago * <i>Medicago orbicularis</i>	Disturbed areas	Uncommon
California burclover * <i>Medicago polymorpha</i>	Disturbed and agricultural areas	Common
White sweetclover * <i>Melilotus alba</i>	Open, disturbed sites	Common
Sourclover * <i>Melilotus indica</i>	Open, disturbed areas	Common
Black locust * <i>Robinia pseudoacacia</i>	Roadsides, canyon slopes, streambanks	Common

<sup>3</sup>The delta tule pea (*Lathyrus jepsonii* var. *jepsonii*) is designated as a Category 2 candidate species by the USFWS and a List 1B plant by the CNPS.

\*non-native plants of California

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Woolly senna * <i>Senna multiglandulosa</i>	Disturbed areas	Uncommon
Spanish broom * <i>Spartium junceum</i>	Disturbed areas	Common
Rose clover * <i>Trifolium hirtum</i>	Disturbed areas, roadsides	Uncommon
Alsike clover * <i>Trifolium hybridum</i>	Disturbed areas	Common
Clover <i>Trifolium obtusiflorum</i>	Moist disturbed areas, gravel bars, marshes	Uncommon
Red clover * <i>Trifolium pratense</i>	Disturbed areas	Common
White clover * <i>Trifolium repens</i>	Agricultural, disturbed, urban areas	Common
Spring vetch * <i>Vicia sativa</i>	Disturbed areas, fields	Common
Winter vetch, Hairy vetch * <i>Vicia villosa</i>	Roadsides, fields, urban waste areas	Common
<b><u>FAGACEAE</u> (OAK FAMILY)</b>		
Coast live oak <i>Quercus agrifolia</i> var. <i>agrifolia</i>	Valleys, slopes, mixed-evergreen forest, woodland	Uncommon
Live oak <i>Quercus chrysolepis</i>	Canyons, shaded slopes, chaparral, woodland	Uncommon
Valley oak <i>Quercus lobata</i>	Slopes, valleys, savannah	Common
<b><u>FRANKENIACEAE</u> (FRANKENIA FAMILY)</b>		
Alkali heath <i>Frankenia salina</i>	Salt marshes, alkali flats	Uncommon
<b><u>GENTIANACEAE</u> (GENTIAN FAMILY)</b>		
Centaury <i>Centaureum davyi</i>	Moist coastal bluffs, dunes, open forests	Uncommon
June centaury <i>Centaureum muehlenbergii</i>	Moist, open forest	Common
<b><u>GERANIACEAE</u> (GERANIUM FAMILY)</b>		
Broad-leaf filaree * <i>Erodium botrys</i>	Dry, open or disturbed sites	Common
Redstem filaree * <i>Erodium cicutarium</i>	Open, disturbed sites, grassland, shrubland	Common
Musk filaree * <i>Erodium moschatum</i>	Open, disturbed sites	Common
Carolina geranium <i>Geranium carolinianum</i>	Open to shaded sites, grassland, shrubland, forest	Common
Geranium * <i>Geranium dissectum</i>	Open, disturbed sites	Common
Davefoot geranium * <i>Geranium molle</i>	Open to shaded sites, disturbed ground	Common

\*non-native plants of California

HALORAGACEAE (WATER-MILFOIL FAMILY)

Parrot's feather * <i>Myriophyllum aquaticum</i>	Ponds, ditches, streams, lakes	Uncommon
Western milfoil <i>Myriophyllum hippuroides</i>	Ponds, ditches, small streams	Common
Water milfoil <i>Myriophyllum sibiricum</i>	Ponds, ditches, streams, lakes	Common

HIPPOCASTANACEAE (BUCKEYE FAMILY)

California buckeye <i>Aesculus californica</i>	Dry slopes, canyons, borders of dry streams	Uncommon
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HIPPURIDACEAE (MARE'S-TAIL FAMILY)

Mare's-tail <i>Hippuris vulgaris</i>	Margins of shallow water, roadsides, irrigation ditches	Common
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HYDROPHYLLACEAE (WATERLEAF FAMILY)

Phacelia <i>Phacelia tanacetifolia</i>	Sandy to gravelly slopes, open areas	Common
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HYPERICACEAE (ST. JOHN'S WORT FAMILY)

Hypericum * <i>Hypericum mutilum</i>	Streambanks, riparian woodland	Uncommon
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JUGLANDACEAE (WALNUT FAMILY)

English walnut * <i>Juglans regia</i>	Persisting near abandoned habitations	Common
Black walnut <i>Juglans californica</i>	Canyons, valleys	Common

LAMIACEAE [Labiatae] (MINT FAMILY)

Dead nettle, Henbit * <i>Lamium amplexicaule</i>	Disturbed sites, cultivated or abandoned fields	Common
Dead nettle * <i>Lamium purpureum</i>	Disturbed sites, meadows	Common
Bugleweed, Water horehound <i>Lycopus americanus</i>	Moist areas, marshes, streambanks	Common
Horehound * <i>Marrubium vulgare</i>	Disturbed sites, generally overgrazed pastures	Common
Mint, Tule mint <i>Mentha arvensis</i>	Moist areas, streambanks, lake shores	Common
Pennyroyal * <i>Mentha pulegium</i>	Moist areas, ditches	Common
<sup>4</sup> Marsh skullcap <i>Scutellaria galericulata</i>	Wet sites, meadows, streambanks, coniferous forest	Rare
Hedge nettle <i>Stachys ajugoides</i> var. <i>rigida</i>	Moist to dry places	Common

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<sup>4</sup>Marsh skullcap (*Scutellaria galericulata*) is regarded as a List 2 plant by the CNPS.

Hedge nettle <i>Stachys albens</i>	Wet, swampy to seepy places	Common
<b>LAURACEAE (LAUREL FAMILY)</b>		
California bay, Pepperwood <i>Umbellularia californica</i>	Canyons, valleys, chaparral	Uncommon
<b>LENTIBULARIACEAE (BLADDERWORT FAMILY)</b>		
Common bladderwort <i>Utricularia vulgaris</i>	Quiet water	Common
<b>LIMNANTHACEAE (MEADOWFOAM FAMILY)</b>		
False mermaid <i>Floerkea proserpinacoides</i>	Moist open places in forest or sagebrush scrub	Common
<b>LYTHRACEAE (LOOSESTRIFE FAMILY)</b>		
Loosestrife <i>Ammannia coccinea</i>	Wet places, drying ponds, lake and creek margins	Uncommon
California loosestrife <i>Lythrum californicum</i>	Marshes, ponds, and stream margins	Common
Loosestrife * <i>Lythrum hyssopifolium</i>	Marshes, drying pond margins	Common
Rotala <i>Rotala ramosior</i>	Irrigated fields, lake and pond margins, streams	Common
<b>MALVACEAE (MALLOW FAMILY)</b>		
Velvet-leaf * <i>Abutilon theophrasti</i>	Disturbed places	Common
<sup>5</sup> California hibiscus <i>Hibiscus lasiocarpus</i>	Wet banks, marshes	Uncommon
Tree-mallow * <i>Lavatera cretica</i>	Disturbed places on coastal bluffs, dunes	Common
Common mallow, Cheeses * <i>Malva neglecta</i>	Disturbed places	Common
Bull mallow * <i>Malva nicaeensis</i>	Disturbed places	Common
Cheeseweed, Little mallow * <i>Malva parviflora</i>	Disturbed places	Common
Alkali-mallow, White-weed <i>Malvella leprosa</i>	Valleys, orchards, generally in saline soils	Common
Modiola * <i>Modiola caroliniana</i>	Lawns, disturbed places	Uncommon
<b>MORACEAE (MULBERRY FAMILY)</b>		
Edible fig * <i>Ficus carica</i>	Moist, disturbed areas, persisting near old habitations	Uncommon
White mulberry * <i>Morus alba</i>	Disturbed areas, moist soil, streambanks	Uncommon

<sup>5</sup>California hibiscus (*Hibiscus lasiocarpus*) is currently designated as a List 1B plant by the CNPS.

\*non-native plants of California

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MYRTACEAE (MYRTLE FAMILY)

Red gum, River red gum * <i>Eucalyptus camaldulensis</i>	Urban areas	Common
Blue gum * <i>Eucalyptus globulus</i>	Disturbed areas	Common
Red iron bark * <i>Eucalyptus sideroxylon</i>	Coastal, disturbed urban areas	Common

OLEACEAE (OLIVE FAMILY)

Oregon ash <i>Fraxinus latifolia</i>	Canyons, streambanks, woodland	Common
Velvet ash <i>Fraxinus velutina</i>	Canyons, streambanks, woodland	Uncommon
Olive * <i>Olea europaea</i>	Cultivated, disturbed places	Common

ONAGRACEAE (EVENING PRIMROSE FAMILY)

Willow herb <i>Epilobium brachycarpum</i>	Dry open woodland, grassland, roadsides	Common
Epilobium <i>Epilobium ciliatum</i> ssp. <i>ciliatum</i>	Disturbed places, streambanks, moist meadows, roadsides	Common
Willow herb <i>Epilobium ciliatum</i> ssp. <i>watsonii</i>	Moist streamsides	Common
Yellow waterweed <i>Ludwigia peploides</i> ssp. <i>peploides</i>	Ditches, shores, streambanks	Common
<sup>6</sup> Antioch dunes evening primrose <i>Oenothera deltoides</i> ssp. <i>howellii</i>	Sandy bluffs, dunes	Rare
Evening primrose <i>Oenothera elata</i> ssp. <i>hirsutissima</i>	Moist places, generally inland	Common

OXALIDACEAE (OXALIS FAMILY)

Bermuda buttercup * <i>Oxalis pes-caprae</i>	Disturbed areas, grassland	Common
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PAPAVERACEAE (POPPY FAMILY)

California poppy <i>Eschscholzia californica</i>	Grassy, open areas	Common
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PITTOSPORACEAE (PITTOSPORUM FAMILY)

Japanese pittosporum, Mock orange * <i>Pittosporum tobira</i>	Disturbed urban areas, cultivated	Common
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<sup>6</sup>The Antioch Dunes evening primrose (*Oenothera deltoides* ssp. *howellii*) is listed as an Endangered species by both the USFWS and the CDFG, and is a List 1B plant by the CNPS.



**PLANTAGINACEAE (PLANTAIN FAMILY)**

English plantain	Waste places, lawns, roadsides	Common
* <i>Plantago lanceolata</i>		
Common plantain	Disturbed areas	Common
* <i>Plantago major</i>		
Plantain	Coastal bluffs and marshes, wet meadows, ditches	Common
<i>Plantago subnuda</i>		

**PLATANACEAE (PLANE TREE, SYCAMORE FAMILY)**

Western sycamore	Streamsides, canyons	Uncommon
<i>Platanus racemosa</i>		

**POLEMONIACEAE (PHLOX FAMILY)**

Globe gilia	Sandhills, flats	Common
<i>Gilia capitata</i> ssp. <i>staminea</i>		

**POLYGONACEAE (BUCKWHEAT FAMILY)**

Coast buckwheat	Coastal bluffs, scrub	Uncommon
<i>Eriogonum latifolium</i>		
Water smartweed	Shallow lakes, streams, shores	Common
<i>Polygonum amphibium</i>		
Common knotweed, Doorweed	Disturbed places	Common
* <i>Polygonum arenastrum</i>		
Knotweed	Fields, disturbed places	Uncommon
* <i>Polygonum argyrocoleon</i>		
Black bindweed	Disturbed places	Common
* <i>Polygonum convolvulus</i>		
Waterpepper	Wet banks	Common
<i>Polygonum hydropiperoides</i>		
Willow weed	Moist places	Uncommon
<i>Polygonum lapathifolium</i>		
Pinkweed	Moist disturbed places, drying ponds	Uncommon
* <i>Polygonum pensylvanicum</i>		
Lady's thumb	Moist urban places	Common
* <i>Polygonum persicaria</i>		
Perennial smartweed	Shallow water, shores	Common
<i>Polygonum punctatum</i>		
Sheep sorrel	Moist, disturbed places	Common
* <i>Rumex acetosella</i>		
Clustered dock	Moist places	Common
* <i>Rumex conglomeratus</i>		
Curly dock	Disturbed places	Common
* <i>Rumex crispus</i>		
Golden dock	Wet, brackish to salty places	Uncommon
<i>Rumex maritimus</i>		
Bitter dock	Moist places	Uncommon
* <i>Rumex obtusifolius</i>		
Willow dock	Moist places	Common
<i>Rumex salicifolius</i>		

\*non-native plants of California

PORTULACACEAE (PURSLANE FAMILY)

Red maids <i>Calandrinia ciliata</i>	Sandy to loamy soil, grassy areas, cultivated fields	Common
Miner's lettuce <i>Claytonia perfoliata</i> ssp. <i>perfoliata</i>	Vernally moist, often shady or disturbed sites	Common
Common purslane * <i>Portulaca oleracea</i>	Disturbed soil	Common

PRIMULACEAE (PRIMROSE FAMILY)

Poor-man's weatherglass * <i>Anagallis arvensis</i>	Disturbed places, ocean beaches	Common
Moneywort * <i>Lysimachia nummularia</i>	Moist meadows	Common
Water-pimpernel <i>Samolus parviflorus</i>	Moist sites	Common

RANUNCULACEAE (BUTTERCUP FAMILY)

Mouse-tail <i>Myosurus minimus</i>	Wet places, vernal pools, marshes	Rare
Aquatic buttercup <i>Ranunculus aquatilis</i> var. <i>capillaceus</i>	Ponds, lake margins, marshes, rivers	Uncommon
Spiney buttercup * <i>Ranunculus muricatus</i>	Wet fields, ditches, vernal pools	Uncommon
Buttercup * <i>Ranunculus repens</i>	Waste areas, ditches, wet fields	Common
Cursed buttercup <i>Ranunculus sceleratus</i>	Shallow water, lake or pond margins, streambanks	Uncommon

ROSACEAE (ROSE FAMILY)

Christmas berry, Toyon <i>Heteromeles arbutifolia</i>	Chaparral, oak woodland, mixed- evergreen forest	Uncommon
Cinquefoil * <i>Potentilla norvegica</i>	Moist, disturbed areas	Uncommon
California rose <i>Rosa californica</i>	Generally moist areas, especially streambanks	Common
Himalayan blackberry * <i>Rubus discolor</i>	Disturbed moist areas, roadsides, fencerows	Common
California blackberry <i>Rubus ursinus</i>	Generally moist places, shrubland, streamsides	Common

RUBIACEAE (MADDER FAMILY)

Button bush <i>Cephalanthus occidentalis</i> var. <i>californicus</i>	Lake, stream edges	Common
Goose grass <i>Galium aparine</i>	Grassy, half-shady places, weedy in gardens	Common
Bedstraw <i>Galium trifidum</i>	Wet places	Common
Field madder	Pastures, lawns	Common

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\**Sherardia arvensis*

SALICACEAE (WILLOW FAMILY)

White poplar	Disturbed places near settlement	Uncommon
* <i>Populus alba</i>		
Fremont cottonwood	Alluvial bottomlands, streamsides	Common
<i>Populus fremontii</i> ssp. <i>fremontii</i>		
Weeping willow	Disturbed places, around settlements	Common
* <i>Salix babylonica</i>		
Sandbar willow, Narrow-leaved willow	Streamsides, marshes, wet ditches	Abundant
<i>Salix exigua</i>		
Goodding's black willow	Streamsides, marshes, seepage areas, washes	Common
<i>Salix gooddingii</i>		
Red willow	Riverbanks, seepage areas, lake shores, canyons, ditches	Common
<i>Salix laevigata</i>		
Arroyo willow	Shores, marshes, meadows, springs, bluffs	Abundant
<i>Salix lasiolepis</i>		
Shining willow	Wet meadows, shores, seepage areas	Common
<i>Salix lucida</i> ssp. <i>lasiandra</i>		

SCROPHULARIACEAE (FIGWORT FAMILY)

Bacopa	Rice fields, muddy places, wet soil, or floating	Uncommon
<i>Bacopa eisenii</i>		
Limosella	Wet, muddy, periodically flooded places	Rare
<i>Limosella aquatica</i>		
<sup>7</sup> Delta mudwort	Muddy or sandy intertidal flats	Uncommon
<i>Limosella subulata</i>		
False pimpernel	Wet places	Common
<i>Lindernia dubia</i> var. <i>dubia</i>		
Monkeyflower	Rocky hillsides, cliffs, canyon slopes, disturbed areas	Common
<i>Mimulus aurantiacus</i>		
Common monkeyflower	Wet places, usually terrestrial, sometimes emergent or floating	Common
<i>Mimulus guttatus</i>		
Musk monkeyflower	Seeps, streambanks, often in partial shade	Common
<i>Mimulus moschatus</i>		
California figwort	Moist places, roadsides, chaparral	Common
<i>Scrophularia californica</i>		
Moth mullein	Disturbed areas	Uncommon
* <i>Verbascum blattaria</i>		
Woolly mullein	Disturbed areas	Common
* <i>Verbascum thapsus</i>		
Water speedwell	Wet meadows, streambanks, slow streams	Common
* <i>Veronica anagallis-aquatica</i>		
Persian speedwell	Lawns, fields	Common
* <i>Veronica persica</i>		

<sup>7</sup>Delta mudwort (*Limosella subulata*) is regarded as a List 2 plant by the CNPS.

\*non-native plants of California

SIMAROUBACEAE (QUASSIA or SIMAROUBA FAMILY)

Tree of heaven	Disturbed urban areas, waste places	Common
* <i>Ailanthus altissima</i>		

SOLANACEAE (NIGHTSHADE FAMILY)

Jimson weed	Sandy soils, open, often disturbed areas	Common
* <i>Datura stramonium</i>		
Tomato	Waste areas, abandoned fields, roadsides	Uncommon
* <i>Lycopersicon esculentum</i>		
Tree tobacco	Open, disturbed flats or slopes	Common
* <i>Nicotiana glauca</i>		
Tobacco	Open, well drained washes, slopes	Uncommon
<i>Nicotiana quadrivalvis</i>		
White nightshade	Open, often disturbed places	Common
<i>Solanum americanum</i>		
Black nightshade	Disturbed places	Common
* <i>Solanum nigrum</i>		

TAMARICACEAE (TAMARISK FAMILY)

Salt cedar	Washes, slopes, sand dunes, roadsides	Uncommon
* <i>Tamarix parviflora</i>		

ULMACEAE (ELM FAMILY)

Hackberry	Canyons, seeps, washes (Escape)	Uncommon
* <i>Celtis occidentalis</i>		
English elm	Waste places, canyons (Cultivated)	Uncommon
* <i>Ulmus minor</i>		
Chinese elm	Waste places, roadsides, washes (Cultivated)	Uncommon
* <i>Ulmus parvifolia</i>		

URTICACEAE (NETTLE FAMILY)

Hoary nettle	Streambanks, margins of deciduous woodlands, moist, waste places	Common
<i>Urtica dioica</i> ssp. <i>holosericea</i>		
Dwarf nettle	Waste areas, gardens, orchards	Common
* <i>Urtica urens</i>		

VERBENACEAE (VERVAIN FAMILY)

Lippia	Wet places, ditches, fields	Common
<i>Phyla nodiflora</i> var. <i>nodiflora</i>		
Verbena	Disturbed, often wet places, fields, roadsides	Common
* <i>Verbena bonariensis</i>		
Verbena	Wet placed, ditches, marshes	Common
<i>Verbena hastata</i>		
Verbena	Disturbed places, fields	Common
* <i>Verbena littoralis</i>		

VISCACEAE (MISTLETOE FAMILY)

Big leaf mistletoe	On woody dicots other than Quercus	Common
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<i>Phoradendron macrophyllum</i>	Oak woodlands, on generally Quercus,	Common
Oak mistletoe	less often other associated woody dicots	
<i>Phoradendron villosum</i>		

#### VITACEAE (GRAPE FAMILY)

Virginia creeper, woodbine	(Cultivated escape)	Uncommon
<i>*Parthenocissus quinquefolia</i>		
Boston ivy	(Cultivated escape)	Uncommon
<i>*Parthenocissus tricuspidata</i>		
Woodbine	Hillsides, thickets, ravines, open	Common
<i>*Parthenocissus vitaceae</i>	woodlands	
California wild grape	Streamsides, springs, canyons	Common
<i>Vitis californica</i>		
Cultivated grape, Wine grape	Abandoned fields, roadsides	Uncommon
<i>*Vitis vinifera</i>		

#### ZYGOPHYLLACEAE (CALTROP FAMILY)

Puncture vine	Roadsides, railways, vacant lots,	Common
<i>*Tribulus terrestris</i>	other dry, disturbed areas	

### FLOWERING PLANTS: MONOCOTYLEDONS

#### ALISMATACEAE (WATER-PLANTAIN FAMILY)

Water plantain	Ponds	Uncommon
<i>Alisma plantago-aquatica</i>		
Burhead	Ponds, ditches	Uncommon
<i>Echinodorus berteroi</i>		
Arrowhead	Ponds, slow streams, ditches	Uncommon
<i>Sagittaria latifolia</i>		
Arrowhead	Ponds, ditches, rice fields	Rare
<i>Sagittaria montevidensis</i> ssp. <i>calycina</i>		
<sup>8</sup> Sanford's arrowhead	Ponds, ditches	Uncommon
<i>Sagittaria sanfordii</i>		

#### ARACEAE (ARUM FAMILY)

Jack-in-the pulpit	Ruderal (Escape)	Uncommon
<i>*Arisaema atrorubens</i>		
Calla lily	Waste ground near former	Uncommon
<i>*Zantedeschia aethiopica</i>	habitations	

#### CYPERACEAE (SEDGE FAMILY)

Sedge	Seasonally wet places	Uncommon
<i>Carex barbarae</i>		
Wooly sedge	Generally marshy places	Common
<i>Carex lanuginosa</i>		

<sup>8</sup>Sanford's arrowhead (*Sagittaria sanfordii*) is currently listed as a Category 2 Candidate species by the USFWS and is a List 2 plant by the CNPS.

\*non-native plants of California

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Sedge		Often alkaline, generally moist places	Common
	<i>Carex praeegracilis</i>		
Sedge		Edges of temporary pools, ponds, streams, ditches	Uncommon
	<i>Cyperus acuminatus</i>		
Sedge		Ditches, pond shores, rice fields	Uncommon
	* <i>Cyperus difformis</i>		
Nutsedge		Vernal pools, streambanks, ditches	Abundant
	<i>Cyperus eragrostis</i>		
Nutsedge		Ditches, riverbanks, shores	Common
	<i>Cyperus erythrorhizos</i>		
Yellow nutsedge		Croplands, disturbed places	Common
	<i>Cyperus esculentus</i>		
Nutsedge		Marshes, swamps, moist roadsides	Common
	<i>Cyperus niger</i>		
Purple nutsedge		Disturbed soils, croplands. Often considered world's worst weed.	Common
	* <i>Cyperus rotundus</i>		
False nutsedge		Moist soils, pond margins, ditches, roadsides	Uncommon
	<i>Cyperus strigosus</i>		
Spikerush		Marshes, meadows, riverbanks, vernal pools	Common
	<i>Eleocharis acicularis</i>		
Spikerush		Marshes, pond margins, vernal pools, ditches	Common
	<i>Eleocharis macrostachya</i>		
Tule		Marshes, lakes, streambanks	Abundant
	<i>Scirpus acutus</i> var. <i>occidentalis</i>		
American bulrush		Marshes, ponds	Common
	<i>Scirpus americanus</i>		
California tule		Marshes	Abundant
	<i>Scirpus californicus</i>		
Miniature tule		Moist, generally sandy soils	Common
	<i>Scirpus cernuus</i>		
Small-fruited bulrush		Marshes, wet meadows, streambanks, pond margins	Uncommon
	<i>Scirpus microcarpus</i>		
Bulrush		Marshes	Uncommon
	<i>Scirpus robustus</i>		

#### HYDROCHARITACEAE (WATERWEED FAMILY)

Elodea, Common waterweed	Shallow water, ditches, ponds, lakes, sloughs	Common
<i>Elodea canadensis</i>		

#### IRIDACEAE (IRIS FAMILY)

Iris	Irrigation ditches, pond margins	Common
* <i>Iris pseudacorus</i>		

#### JUNCACEAE (RUSH FAMILY)

Rush	Sandy riverbanks, lake shores, ditches	Common
	<i>Juncus acuminatus</i>	
Rush	Moist, saline places	Uncommon
	<i>Juncus acutus</i> ssp. <i>leopoldii</i>	
Baltic rush	Moist to rather dry places	Common

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<i>Juncus balticus</i>		
Toad rush	Moist (sometimes saline) open or disturbed places	Common
<i>Juncus bufonius</i>		
Soft rush	Wet places	Abundant
<i>Juncus effusus</i>		
Mexican rush	Coast to montane meadows	Uncommon
<i>Juncus mexicanus</i>		
Rush	Wet places, coastal and inland	Uncommon
<i>Juncus phaeocephalus</i> var. <i>paniculatus</i>		
Iris-leaved rush	Wet places	Uncommon
<i>Juncus xiphioides</i>		
<b><u>JUNCAGINACEAE (ARROW-GRASS FAMILY)</u></b>		
Flowering-quillwort	Vernal pools, ditches, streams, ponds, lake margins	Uncommon
<i>Lilaea scilloides</i>		
<b><u>LEMNACEAE (DUCKWEED FAMILY)</u></b>		
Duckweed	Freshwater	Abundant
<i>Lemna minor</i>		
Duckmeat	Freshwater	Uncommon
<i>Spirodela polyrrhiza</i>		
<b><u>LILIACEAE (LILY FAMILY)</u></b>		
Asparagus	Disturbed places, roadsides, fields	Common
* <i>Asparagus officinalis</i>		
Brodiaea	Grassland, volcanic mesas	Rare
<i>Brodiaea coronaria</i>		
Lily	Moist places, streambanks, along coast	Uncommon
<i>Lilium pardalinum</i>		
<b><u>POACEAE [Gramineae] (GRASS FAMILY)</u></b>		
Redtop creeping bent grass	Roadsides, fields, ditches, disturbed places	Common
* <i>Agrostis gigantea</i>		
Agrostis	Disturbed areas, wet areas, ponds, ditches, streambanks	Uncommon
* <i>Agrostis viridis</i>		
Pacific foxtail	Vernal pools, moist, open meadows	Common
<i>Alopecurus saccatus</i>		
Giant reed	Moist places, seeps, ditchbanks	Common
* <i>Arundo donax</i>		
Slender wild oat	Disturbed sites	Common
* <i>Avena barbata</i>		
Wild oat	Disturbed sites	Common
* <i>Avena fatua</i>		
Cultivated oat	Disturbed sites	Common
* <i>Avena sativa</i>		
Bamboo	Disturbed areas (Cultivated)	Common
* <i>Bambusa</i> sp.		
Ripgut grass	Open, generally disturbed places, fields	Common
* <i>Bromus diandrus</i>		
Soft brome	Open, often disturbed places	Common

\*non-native plants of California

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<i>*Bromus hordeaceus</i>	Disturbed sites	Uncommon
Pampas grass		
<i>*Cortaderia selloana</i>	Wet soils, lake margins, vernal pools	Uncommon
Prickle grass		
<i>*Crypsis vaginiflora</i>	Disturbed sites	Abundant
Bermuda grass		
<i>*Cynodon dactylon</i>	Disturbed places, fields, roadsides	Common
Crab grass		
<i>*Digitaria sanguinalis</i>	Salt marshes, moist, alkaline areas	Common
Saltgrass		
<i>Distichlis spicata</i>	Wet places, fields	Common
Water grass		
<i>*Echinochloa colona</i>	Waste places, often wet sites, fields, roadsides	Common
Barnyard grass	Open areas, chaparral, woodland, forest	Uncommon
<i>*Echinochloa crus-galli</i>	Weed in disturbed areas, cultivated fields	Uncommon
Blue wildrye	Sand or mud near streams, lakes	Common
<i>Elymus glaucus</i>		
Quackgrass	Disturbed places	Common
<i>Elytrigia repens</i>	Dry to moist, disturbed sites	Common
Lovegrass	Dry to moist, disturbed sites	Common
<i>Eragrostis hypnoides</i>		
Tall fescue		
<i>*Festuca arundinacea</i>	Dry to moist, disturbed sites	Common
Mediterranean barley, Foxtail		
<i>*Hordeum marinum</i>	Dry to moist, disturbed sites	Common
Foxtail		
<i>*Hordeum murinum</i> ssp. <i>glaucum</i>	Dry to moist, disturbed sites	Common
Hare barley		
<i>*Hordeum murinum</i> ssp. <i>leporinum</i>	Marshes, streams, ponds	Common
Rice cutgrass		
<i>Leersia oryzoides</i>	Marshes, wetlands, sometimes wet disturbed areas	Uncommon
Bearded sprangletop	Moist, often saline, meadows	Common
<i>Leptochloa fascicularis</i>		
Beardless wild-rye	Disturbed sites, abandoned fields	Common
<i>Leymus triticoides</i>		
Italian ryegrass	Open, disturbed sites	Common
<i>*Lolium multiflorum</i>		
Darnel	Open places, fields	Common
<i>*Lolium temulentum</i>		
Witchgrass	Moist places, ditches, roadsides	Abundant
<i>Panicum capillare</i>		
Dallis grass	Moist places, marshes, ditches	Uncommon
<i>*Paspalum dilatatum</i>		
Knot grass	Wet streambanks, moist areas, grassland, woodland	Uncommon
<i>Paspalum distichum</i>	Wet areas, ditches	Uncommon
Reed canary grass		
<i>Phalaris arundinacea</i>		
Harding grass		
<i>*Phalaris aquatica</i>		

\*non-native plants of California

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Canary grass * <i>Phalaris canariensis</i>	Disturbed areas	Common
Canary grass * <i>Phalaris minor</i>	Disturbed areas	Uncommon
Common reed <i>Phragmites australis</i>	Pond and lake margins, sloughs, marshes	Common
Annual bluegrass * <i>Poa annua</i>	Disturbed, moist ground, lawns, etc.	Common
Mediterranean beard grass * <i>Polypogon maritimus</i>	Moist places	Uncommon
Annual beard grass, Rabbitfoot grass * <i>Polypogon monspeliensis</i>	Moist places, along streams, ditches	Uncommon
Alkali grass <i>Puccinellia</i> sp.	Marshes, wet sites	Common
Bristlegrass <i>Setaria gracilis</i>	Open areas, grassland, chaparral	Uncommon
Johnsongrass * <i>Sorghum halepense</i>	Disturbed areas, ditchbanks, roadsides	Abundant
Milo * <i>Sorghum vulgare</i>	Agricultural fields (Escape)	Uncommon
Wheat * <i>Trisetum aestivum</i>	Disturbed areas, agricultural fields (Cultivated)	Common
Corn * <i>Zea mays</i>	Disturbed areas, agricultural fields (Cultivated)	Abundant

#### PONTEDERIACEAE (PICKEREL-WEED FAMILY)

Water hyacinth * <i>Eichhornia crassipes</i>	Ponds, sloughs, waterways	Abundant
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#### POTAMOGETONACEAE (PONDWEED FAMILY)

Crispate-leaved pondweed * <i>Potamogeton crispus</i>	Shallow water, ponds, reservoirs, streams	Common
Diverse-leaved pondweed <i>Potamogeton diversifolius</i>	Shallow water, ditches, ponds, lakes	Common
Slender-leaved pondweed <i>Potamogeton filiformis</i>	Shallow, clear water of lakes and drainage channels	Common
Leafy pondweed <i>Potamogeton foliosus</i>	Shallow water, ponds, lakes, streams, irrigation ditches	Common
Long-leaved pondweed <i>Potamogeton nodosus</i>	Shallow water, lakes, ponds, ditches, streams	Common
Fennel-leaf pondweed <i>Potamogeton pectinatus</i>	Ponds, lakes, marshes, streams	Common
Small pondweed <i>Potamogeton pusillus</i>	Shallow water, ponds, lakes, reservoirs, ditches, vernal pools, slow streams	Common
Eel-grass pondweed <i>Potamogeton zosteriformis</i>	Ponds, lakes, streams	Common
Ditch-grass <i>Ruppia cirrhosa</i>	Marshes, ponds, sloughs	Common

#### TYPHACEAE (CATTAIL FAMILY)

Bur-reed	Marshes	Common
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\*non-native plants of California

<i>Sparganium eurycarpum</i> ssp. <i>eurycarpum</i>	Marshes	Common
Narrow-leaved cattail <i>Typha angustifolia</i>	Marshes	Common
Southern cattail <i>Typha domingensis</i>	Marshes, ponds, lakes	Common
Broad-leaved cattail <i>Typha latifolia</i>		

ZANNICHELLIACEAE (HORNED-PONDWEED FAMILY)

Horned-pondweed <i>Zannichellia palustris</i>	Streams, ponds, ditches, lakes	Common
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\*non-native plants of California

B-23

**APPENDIX C**

**FAUNA OF THE  
SACRAMENTO-SAN JOAQUIN DELTA**

## Appendix C

### FAUNA

#### Wildlife of the Sacramento-San Joaquin Delta

Modified from US ARMY CORPS OF ENGINEERS, SACRAMENTO-SAN JOAQUIN DELTA ENVIRONMENTAL ATLAS (1979).

Status abbreviations: SE = State Endangered, ST = State Threatened, SC = State Candidate for listing, CSC = California Species of Special Concern, FE = Federally Endangered, FT = Federally Threatened, FP = Federally Proposed for listing, FC1 = Federal Category 1 Candidate, FC2 = Federal Category 2 Candidate, FC3 = Federal Category 3 Candidate.

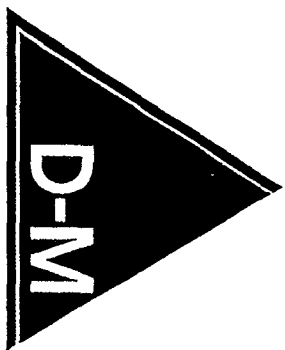
Habitat abbreviations: Aq = Aquatic, Ag = Agricultural, M = Marsh, R = Riparian, Up = Upland, and Ur = Urban.

<u>COMMON AND SCIENTIFIC NAMES</u>	<u>STATUS</u>	<u>HABITAT</u>	<u>ABUNDANCE IN DELTA</u>
<b>AMPHIBIANS</b>			
California slender salamander <i>Batrachoseps attenuatus</i>		Up	Uncommon
Western toad <i>Bufo boreas</i>		R, M, Up, Ag, Ur	Common
Pacific tree frog <i>Hyla regilla</i>		R, M, Up, Ag	Common
Bullfrog <i>Rana catesbieana</i>		R, M	Common
<b>REPTILES</b>			
Western pond turtle <i>Clemmys marmorata</i>	CSC, FC2	R, M, Aq	Common
Western fence lizard <i>Sceloporus occidentalis</i>		R, Up, Ag	Common
Side-blotched lizard <i>Uta stansburiana</i>		R, Up, Ag	Uncommon
Western skink <i>Eumeces gilberti</i>		R, M, Up, Ag	Uncommon
Gilbert's skink <i>Eumeces skiltonianus</i>		R, M, Up, Ag	Uncommon
Western whiptail <i>Cnemidophorus tigris</i>		Up, Ag	Uncommon
Southern alligator lizard <i>Gerrhonotus multicarinatus</i>		R, Up, Ag	Uncommon
Northern alligator lizard <i>Gerrhonotus coeruleus</i>		R, Up, Ag	Uncommon
California legless lizard <i>Anniella pulchra</i>		R, Up	Uncommon
Ringneck snake <i>Diadophis punctatus</i>		R, Up	Uncommon
Sharp-tailed snake <i>Contia tenuis</i>		R, Up, Ag	Uncommon
Racer <i>Coluber constrictor</i>		Up, Ag	Common

Pacific gopher snake <i>Pituophis melanoleucus</i>		R, Up, Ag	Common
Common kingsnake <i>Lampropeltis getulus</i>		R, M, Up, Ag	Common
Common garter snake <i>Thamnophis sirtalis</i>		R, Up, Ag	Common
Western terrestrial garter snake <i>Thamnophis elegans</i>		Up, Ag	Uncommon
Giant garter snake <i>Thamnophis gigas</i>	ST, FT	M, Up	Uncommon
Western rattlesnake <i>Crotalus viridis</i>		Up	Uncommon

## BIRDS

Red-throated loon <i>Gavia stellata</i>		Aq	Occasional
Pacific loon <i>Gavia arctica</i>		Aq	Occasional
Common loon <i>Gavia immer</i>	CSC (breeding)	Aq	Occasional
Pied-billed grebe <i>Podilymbus podiceps</i>		M, Aq	Common
Horned grebe <i>Podiceps auritus</i>		Aq	Uncommon
Eared grebe <i>Podiceps nigricollis</i>		Aq	Uncommon
Western grebe <i>Aechmophorus occidentalis</i>		Aq	Common
American white pelican <i>Pelecanus erythrorhynchos</i>	CSC (nesting colony)	Aq	Occasional
Double-crested cormorant <i>Phalacrocorax auritus</i>	CSC (rookery)	Aq	Common
American bittern <i>Botaurus lentiginosus</i>		M	Common
Western least bittern <i>Ixobrychus exilis hesperis</i>	CSC, FC2	M	Rare
Great blue heron <i>Ardea herodias</i>		R, M, Ag	Common
Great egret <i>Casmerodius albus</i>		R, M, Ag	Common
Snowy egret <i>Egretta thula</i>		R, M, Ag	Common
Cattle egret <i>Bubulcus ibis</i>		Up, Ag	Uncommon
Green-backed heron <i>Butorides striatus</i>		R, M, Ag	Common
Black-crowned night-heron <i>Nycticorax nycticorax</i>		R, M	Common
White-faced ibis <i>Plegadis chihi</i>	CSC, FC2 (rookery)	M	Uncommon



**GAP**

**NOTED**

Trumpeter swan		Aq, Ag	Accidental
<i>Cygnus buccinator</i>			
Tundra swan		M, Up, Aq, Ag	Common
<i>Cygnus columbianus</i>			
Greater white-fronted goose		M, Up, Ag	Common
<i>Anser albifrons</i>			
Snow goose		M, Up, Ag	Common
<i>Chen caerulescens</i>			
Ross' goose		M, Up, Ag	Common
<i>Chen rossii</i>			
Canada goose		M, Up, Ag	Common
<i>Branta canadensis</i>			
Aleutian Canada goose	FT	M, Up, Ag	Occasional
<i>Branta canadensis leucopareia</i>			
Wood duck		M, R	Occasional
<i>Aix sponsa</i>			
Green-winged teal		M, Aq, Ag	Common
<i>Anas crecca</i>			
Mallard		M, Aq, Up, Ag	Common
<i>Anas platyrhynchos</i>			
Northern pintail		M, Aq, Up, Ag	Common
<i>Anas acuta</i>			
Blue-winged teal		M	Occasional
<i>Anas discors</i>			
Cinnamon teal		M, Aq	Common
<i>Anas cyanoptera</i>			
Northern shoveler		M	Common
<i>Anas clypeata</i>			
Gadwall		Aq, M	Common
<i>Anas strepera</i>			
American widgeon		M, Ag	Common
<i>Anas americana</i>			
Canvasback		M, Aq	Common
<i>Aythya valisineria</i>			
Redhead		M, Aq	Common
<i>Aythya americana</i>			
Ring-necked duck		M, Aq	Uncommon
<i>Aythya collaris</i>			
Greater scaup		M, Aq	Uncommon
<i>Aythya marila</i>			
Lesser scaup		M, Aq	Uncommon
<i>Aythya affinis</i>			
Common goldeneye		M, Aq	Common
<i>Bucephala clangula</i>			
Bufflehead		M, Aq	Common
<i>Bucephala albeola</i>			
Hooded merganser		R, Aq	Occasional
<i>Lophodytes cucullatus</i>			
Common merganser		Aq	Uncommon
<i>Mergus merganser</i>			

Red-breasted merganser <i>Mergus serrator</i>		Aq	Uncommon
Ruddy duck <i>Oxyura jamaicensis</i>		M, Aq	Common
Turkey vulture <i>Cathartes aura</i>		M, Up, Ag	Common
Black-shouldered kite <i>Elanus caeruleus</i>		M, Up, Ag	Common
Bald eagle <i>Haliaeetus leucocephalus</i>	SE, FE	R, Up	Uncommon
Northern harrier <i>Circus cyaneus</i>	CSC (nesting)	M, Up, Ag	Common
Sharp-shinned hawk <i>Accipiter striatus</i>	CSC (nesting)	R, Up	Occasional
Cooper's hawk <i>Accipiter cooperii</i>	CSC (nesting)	R, Up	Occasional
Red-shouldered hawk <i>Buteo lineatus</i>		R, Up, Ag	Uncommon
Swainson's hawk <i>Buteo swainsoni</i>	ST, FC3 (nesting)	Up, Ag	Occasional
Red-tailed hawk <i>Buteo jamaicensis</i>		R, Up, Ag	Common
Ferruginous hawk <i>Buteo regalis</i>	CSC, FC2 (wintering)	Up, Ag	Occasional
Rough-legged hawk <i>Buteo lagopus</i>		Up, Ag	Uncommon
Golden eagle <i>Aquila chrysaetos</i>	CSC	Up, Ag	Uncommon
American kestrel <i>Falco sparverius</i>		Up, Ag	Common
Merlin <i>Falco columbarius</i>	CSC	M, Up, Ag	Uncommon
Peregrine falcon <i>Falco peregrinus</i>	SE, FE (nesting)	M, Up, Ag	Uncommon
Prairie falcon <i>Falco mexicanus</i>	CSC (nesting)	Up, Ag	Uncommon
Ring-necked pheasant <i>Phasianus colchicus</i>		Up, Ag	Common
California quail <i>Callipepla californica</i>		R, Up	Common
Black rail <i>Laterallus jamaicensis</i>	ST, FC2	M	Uncommon
Virginia rail <i>Rallus limicola</i>		M	Common
Sora <i>Porzana carolina</i>		M	Common
Common moorhen <i>Gallinula chloropus</i>		M	Common
American coot <i>Fulica americana</i>		M, Aq	Common



Sandhill crane		Up, Ag	Common
<i>Grus canadensis</i>			
Greater sandhill crane	ST	Up, Ag	Common
<i>Grus canadensis tabida</i>			
Black-bellied plover		M, Up, Ag	Common
<i>Pluvialis squatarola</i>			
Semipalmated plover		M	Uncommon
<i>Charadrius semipalmatus</i>			
Killdeer		M, Up, Ag	Common
<i>Charadrius vociferus</i>			
Mountain plover	CSC, FC2	Up	Occasional
<i>Charadrius montanus</i>	(wintering)		
Black-necked stilt		M	Common
<i>Himantopus mexicanus</i>			
American avocet		M	Common
<i>Recurvirostra americana</i>			
Greater yellowlegs		M, Ag	Common
<i>Tringa melanoleuca</i>			
Lesser yellowlegs		M, Ag	Uncommon
<i>Tringa flavipes</i>			
Willet		M, Ag	Uncommon
<i>Catoptrophorus semipalmatus</i>			
Spotted sandpiper		M, Ag	Uncommon
<i>Actitis macularia</i>			
Whimbrel		M, Ag	Uncommon
<i>Numenius phaeopus</i>			
Long-billed curlew	CSC (breeding)	M, Ag	Common
<i>Numenius americanus</i>			
Marbled godwit		M	Uncommon
<i>Limosa fedoa</i>			
Western sandpiper		M	Common
<i>Calidris mauri</i>			
Least sandpiper		M	Common
<i>Calidris minutilla</i>			
Solitary sandpiper		M, Ag	Occasional
<i>Tringa solitaria</i>			
Dunlin		M	Common
<i>Calidris alpina</i>			
Short-billed dowitcher		M, Ag	Occasional
<i>Limnodromus griseus</i>			
Long-billed dowitcher		M, Ag	Common
<i>Limnodromus scolopaceus</i>			
Common snipe		M, Ag	Common
<i>Gallinago gallinago</i>			
Wilson's phalarope		M	Uncommon
<i>Phalaropus tricolor</i>			
Red-necked phalarope		Aq	Occasional
<i>Phalaropus lobatus</i>			
Bonaparte's gull		M, Aq, Ag	Common
<i>Larus philadelphia</i>			

Mew gull		M, Aq, Ag, Ur	Occasional
<i>Larus canus</i>			
Ring-billed gull		M, Aq, Ag, Ur	Common
<i>Larus delawarensis</i>			
California gull	CSC (nesting colony)	M, Aq, Ag, Ur	Common
<i>Larus californicus</i>			
Herring gull		M, Aq, Ag, Ur	Common
<i>Larus argentatus</i>			
Western gull		M, Aq, Ag, Ur	Common
<i>Larus occidentalis</i>			
Glaucous-winged gull		M, Aq, Ag, Ur	Common
<i>Larus glaucescens</i>			
Caspian tern		M, Aq	Common
<i>Sterna caspia</i>			
Forster's tern		M, Aq	Common
<i>Sterna forsteri</i>			
Black tern	CSC, FC2 (nesting colony)	M, Aq	Occasional
<i>Chlidonias niger</i>			
Rock dove		Up, Ag, Ur	Common
<i>Columba livia</i>			
Band-tailed pigeon		Up	Occasional
<i>Columba fasciata</i>			
Mourning dove		Up, Ag, Ur	Common
<i>Zenaida macroura</i>			
Barn owl		M, Up, Ag, Ur	Occasional
<i>Tyto alba</i>			
Western screech-owl		R, Up, Ag, Ur	Uncommon
<i>Otus kennicottii</i>			
Great horned owl		R, Up, Ag	Common
<i>Bubo virginianus</i>			
Burrowing owl	CSC (burrow sites)	Up, Ag	Occasional
<i>Athene cunicularia</i>			
Long-eared owl	CSC (nesting)	R, Up, Ag	Occasional
<i>Asio otus</i>			
Short-eared owl	CSC (nesting)	R, M, Up	Occasional
<i>Asio flammeus</i>			
Lesser nighthawk		M, Up, Ag, Ur	Occasional
<i>Chordeiles acutipennis</i>			
Common poorwill		Up	Uncommon
<i>Phalaenoptilus nuttallii</i>			
Vaux's swift	CSC	M, Up, Ag, Ur	Occasional
<i>Chaetura vauxi</i>			
White-throated swift		M, Up, Ag, Ur	Uncommon
<i>Aeronautes saxatalis</i>			
Anna's hummingbird		R, Up, Ur	Common
<i>Calypte anna</i>			
Rufous hummingbird		R, Up, Ur	Uncommon
<i>Salasphorus rufus</i>			
Allen's hummingbird		R, Up, Ur	Occasional
<i>Selasphorus sasin</i>			

Belted kingfisher		R, M, Aq	Common
<i>Ceryle alcyon</i>			
Lewis's woodpecker		R, Up	Occasional
<i>Melanerpes lewis</i>			
Acorn woodpecker		R, Up	Common
<i>Melanerpes formicivorus</i>			
Red-breasted sapsucker		R, Up	Occasional
<i>Sphyrapicus ruber</i>			
Nuttall's woodpecker		R, Up, Ur	Common
<i>Picoides nuttallii</i>			
Downy woodpecker		R, Up, Ur	Occasional
<i>Picoides pubescens</i>			
Hairy woodpecker		R, Up, Ur	Occasional
<i>Picoides villosus</i>			
Northern flicker		R, Up, Ag, Ur	Common
<i>Colaptes auratus</i>			
Olive-sided flycatcher		R, Up	Rare
<i>Contopus borealis</i>			
Western wood-pewee		R, M, Up	Rare
<i>Contopus sordidulus</i>			
Willow flycatcher	CSC	R	Occasional
<i>Empidonax traillii</i>			
Black phoebe		R, M, Up, Ur	Common
<i>Sayornis nigricans</i>			
Say's phoebe		Up, Ag	Occasional
<i>Sayornis saya</i>			
Ash-throated flycatcher		R, Up	Occasional
<i>Myiarchus cinerascens</i>			
Western kingbird		R, Up, Ag	Common
<i>Tyrannus verticalis</i>			
Horned lark		Up, Ag	Uncommon
<i>Eremophila alpestris</i>			
Tree swallow		R, Up	Occasional
<i>Tachycineta bicolor</i>			
Violet-green swallow		R, Up	Occasional
<i>Tachycineta thalassina</i>			
Northern rough-winged swallow		R, M, Aq	Uncommon
<i>Stelgidopteryx serripennis</i>			
Bank swallow	ST	R, M, Aq	Rare
<i>Riparia riparia</i>			
Cliff swallow		M, Up, Ag, Ur	Common
<i>Hirundo pyrrhonota</i>			
Barn swallow		M, Up, Ag, Ur	Common
<i>Hirundo rustica</i>			
Scrub jay		R, Up, Ur	Common
<i>Aphelocoma coerulescens</i>			
Yellow-billed magpie		Up, Ag, Ur	Common
<i>Pica nuttalli</i>			
American crow		Up, Ag	Common
<i>Corvus brachyrhynchos</i>			

Common raven <i>Corvus corax</i>	Up, Ag	Occasional
Plain titmouse <i>Parus inornatus</i>	R, Up, Ur	Common
Bushtit <i>Psaltiriparus minimus</i>	R, Up, Ur	Common
White-breasted nuthatch <i>Sitta carolinensis</i>	R, Up	Uncommon
Bewick's wren <i>Thryomanes bewickii</i>	R, Up, Ur	Common
House wren <i>Troglodytes aedon</i>	R, Up, Ur	Common
Winter wren <i>Troglodytes troglodytes</i>	Up	Uncommon
Marsh wren <i>Cistothorus palustris</i>	M	Common
Golden-crowned kinglet <i>Regulus satrapa</i>	R, Up, Ur	Occasional
Ruby-crowned kinglet <i>Regulus calendula</i>	R, Up, Ur	Common
Western bluebird <i>Sialia mexicana</i>	Up, Ag	Uncommon
Swainson's thrush <i>Catharus ustulatus</i>	R, Up, Ur	Occasional
Hermit thrush <i>Catharus guttatus</i>	R, Up, Ur	Occasional
American robin <i>Turdus migratorius</i>	Up, Ag, Ur	Common
Varied thrush <i>Ixoreus naevius</i>	R, Up	Occasional
Wrentit <i>Chamaea fasciata</i>	Up	Occasional
Northern mockingbird <i>Mimus polyglottos</i>	Up, Ag, Ur	Common
Sage thrasher <i>Oreoscoptes montanus</i>	Up, Ag	Occasional
Water pipit <i>Anthus spinoletta</i>	Up, Ag	Occasional
Cedar waxwing <i>Bombycilla cedrorum</i>	R, Up, Ur	Occasional
Loggerhead shrike <i>Lanius ludovicianus</i>	CSC, FC2 R, Up, Ur	Uncommon
European starling <i>Sturnus vulgaris</i>	R, Up, Ag, Ur	Common
Solitary vireo <i>Vireo solitarius</i>	R, Up	Occasional
Hutton's vireo <i>Vireo huttoni</i>	R, Up	Occasional
Warbling vireo <i>Vireo gilvus</i>	R, Up	Occasional

Orange-crowned warbler <i>Vermivora celata</i>		R, Up	Occasional
Nashville warbler <i>Vermivora ruficapilla</i>		R, Up	Occasional
Yellow warbler <i>Dendroica petechia</i>	CSC	R, Up, Ur	Uncommon
Yellow-rumped warbler <i>Dendroica coronata</i>		R, M, Up, Ag, Ur	Common
Black-throated gray warbler <i>Dendroica nigrescens</i>		R, Up	Occasional
Hermit warbler <i>Dendroica occidentalis</i>		R, Up	Occasional
MacGillivray's warbler <i>Oporornis tolmiei</i>		R, Up	Occasional
Common yellowthroat <i>Geothlypis trichas</i>		R, M, Up	Common
Wilson's warbler <i>Wilsonia pusilla</i>		R, M, Up	Uncommon
Yellow-breasted chat <i>Icteria virens</i>		R, M, Up	Uncommon
Western tanager <i>Piranga ludoviciana</i>		R, Up, Ur	Occasional
Black-headed grosbeak <i>Pheucticus melanocephalus</i>		R, Up	Common
Blue grosbeak <i>Guiraca caerulea</i>		R, Up	Occasional
Rufous-sided towhee <i>Pipilo erythrophthalmus</i>		R, Up, Ag	Common
California towhee <i>Pipilo crissalis</i>		R, Up, Ag, Ur	Common
Chipping sparrow <i>Spizella passerina</i>		Up, Ag, Ur	Occasional
Lark sparrow <i>Chondestes grammacus</i>		Up, Ag, Ur	Occasional
Savannah sparrow <i>Passerculus sandwichensis</i>		Up, Ag	Common
Grasshopper sparrow <i>Ammodramus savannarum</i>		Up, Ag	Occasional
Fox sparrow <i>Passerella iliaca</i>		R, Up, Ag	Common
Song sparrow <i>Melospiza melodia</i>		R, M, Up	Common
Suisun song sparrow <i>Melospiza melodia maxillaris</i>	CSC, FC2	M	Uncommon
Lincoln's sparrow <i>Melospiza lincolnii</i>		R, Up, Ag	Common
Golden-crowned sparrow <i>Zonotrichia atricapilla</i>		R, Up, Ag, Ur	Common
White-crowned sparrow <i>Zonotrichia leucophrys</i>		R, Up, Ag, Ur	Common

Dark-eyed junco <i>Junco hyemalis</i>		R, Up, Ag, Ur	Common
Red-winged blackbird <i>Agelaius phoeniceus</i>		R, M, Up, Ag	Common
Tricolored blackbird <i>Agelaius tricolor</i>	CSC, FC2	R, M, Up, Ag	Occasional
Western meadowlark <i>Sturnella neglecta</i>		Up, Ag	Common
Yellow-headed blackbird <i>Xanthocephalus xanthocephalus</i>		M, Up, Ag	Uncommon
Brewer's blackbird <i>Euphagus cyanocephalus</i>		R, M, Up, Ag, Ur	Common
Brown-headed cowbird <i>Molothrus ater</i>		R, M, Up, Ag	Common
Hooded oriole <i>Icterus cucullatus</i>		R, Up, Ur	Occasional
Northern oriole <i>Icterus galbula</i>		R, Up, Ur	Common
Purple finch <i>Carpodacus purpureus</i>		R, Up, Ag, Ur	Occasional
House finch <i>Carpodacus mexicanus</i>		R, Up, Ag, Ur	Common
Lesser goldfinch <i>Carduelis psaltria</i>		Up, Ag	Common
American goldfinch <i>Carduelis tristis</i>		Up, Ag, Ur	Common
House sparrow <i>Passer domesticus</i>		R, Up, Ag, Ur	Common

#### M A M M A L S

Virginia opossum <i>Didelphis virginiana</i>		R, Up, Ag	Common
Vagrant shrew <i>Sorex vagrans</i>		R, M, Up, Ag	Uncommon
Ornate shrew <i>Sorex ornatus</i>		R, M, Up, Ag	Occasional
Towbridge shrew <i>Sorex towbridgii</i>		R, Up	Common
Suisun shrew <i>Sorex sinuosus</i>	CSC, FC1	R, M, Ag	Uncommon
Shrew mole <i>Neurotrichus gibbsii</i>		R, M	Occasional
Broad-footed mole <i>Scapanus latimanus</i>		R, M, Up, Ag	Occasional
Little brown myotis <i>Myotis lucifugus</i>		R, M, Up, Ag, Ur	Uncommon
Yuma myotis <i>Myotis yumanensis</i>		R, M, Up, Ag, Ur	Common
Long-eared myotis <i>Myotis evotis</i>		R, M, Up, Ag, Ur	Common

Fringed myotis		R, M, Up, Ag, Ur	Occasional
<i>Myotis thysanodes</i>			
Long-legged myotis		Up, Ur	Uncommon
<i>Myotis volans</i>			
California myotis		R, Up, Ur	Common
<i>Myotis californicus</i>			
Silver-haired bat		R, M, Up, Ag, Ur	Occasional
<i>Lasionycteris noctivagans</i>			
Western pipistrel		R, Up, Ag, Ur	Common
<i>Pipistrellus hesperus</i>			
Big brown bat		R, M, Up, Ag, Ur	Common
<i>Eptesicus fuscus</i>			
Red bat		R, M, Up	Common
<i>Lasiurus borealis</i>			
Hoary bat		R, M, Up	Common
<i>Lasiurus cinereus</i>			
Townsend's big-eared bat	CSC	Up, Ur	Occasional
<i>Plecotus townsendii</i>			
Pallid bat	CSC	R, M, Up, Ag, Ur	Occasional
<i>Antrozous pallidus</i>			
Brazilian free-tailed bat		Up, Ur	Occasional
<i>Tadarida brasiliensis</i>			
Western mastiff bat	CSC	R, M, Up, Ur	Occasional
<i>Eumops perotis</i>			
Brush rabbit		Up	Occasional
<i>Sylvilagus bachmani</i>			
Riparian brush rabbit	CSC, FC1	R	Rare
<i>Sylvilagus bachmani riparius</i>			
Desert cottontail		R, Up, Ag	Common
<i>Sylvilagus audubonii</i>			
Black-tailed hare		R, Up, Ag	Common
<i>Lepus californicus</i>			
California ground squirrel		R, Up, Ag	Common
<i>Spermophilus beecheyi</i>			
Western gray squirrel		R, Up	Occasional
<i>Sciurus griseus</i>			
Botta's pocket gopher		R, Up, Ag, Ur	Common
<i>Thomomys bottae</i>			
San Joaquin pocket mouse		Up, Ag	Occasional
<i>Perognathus inornatus</i>			
Beaver		R, M, Aq	Common
<i>Castor canadensis</i>			
Western harvest mouse		R, M, Up, Ag	Common
<i>Reithrodontomys megalotis</i>			
Salt-marsh harvest mouse	SE, FE	R, M	Rare
<i>Reithrodontomys raviventris</i>			
California mouse		R, Up, Ag, Ur	Occasional
<i>Peromyscus californicus</i>			
Deer mouse		R, M, Up, Ag, Ur	Common
<i>Peromyscus maniculatus</i>			

Dusky-footed woodrat		R, M, Up	Common
<i>Neotoma fuscipes</i>			
San Joaquin Valley woodrat	CSC, FC1	R	Rare
<i>Neotoma fuscipes riparia</i>			
California vole		R, Up	Occasional
<i>Microtus californicus</i>			
Muskrat		R, M, Aq	Common
<i>Ondatra zibethicus</i>			
Black rat		Up, Ag, Ur	Common
<i>Rattus rattus</i>			
Norway rat		R, M, Up, Ag, Ur	Common
<i>Rattus norvegicus</i>			
House mouse		R, Up, Ag, Ur	Common
<i>Mus musculus</i>			
Coyote		Up	Occasional
<i>Canis latrans</i>			
Red fox		R, Up	Uncommon
<i>Vulpes vulpes</i>			
San Joaquin kit fox	ST, FE	Up	Rare
<i>Vulpes macrotis mutica</i>			
Gray fox		R, Up	Occasional
<i>Urocyon cinereoargenteus</i>			
Ringtail		R, M, Up	Uncommon
<i>Bassariscus astutus</i>			
Raccoon		R, Up	Occasional
<i>Procyon lotor</i>			
Long-tailed weasel		R, M, Up, Ag	Occasional
<i>Mustela frenata</i>			
Mink		R, M, Aq, Up, Ag	Uncommon
<i>Mustela vison</i>			
Badger	CSC	Up	Occasional
<i>Taxidea taxus</i>			
Western spotted skunk		R, M, Up	Occasional
<i>Spilogale gracilis</i>			
Striped skunk		R, M, Up, Ag	Common
<i>Mephitis mephitis</i>			
River otter		R, M	Uncommon
<i>Lutra canadensis</i>			
Bobcat		R, Up	Uncommon
<i>Felis rufus</i>			
Mule deer		R, Up, Ag	Occasional
<i>Odocoileus hemionus</i>			



**APPENDIX D**

**FISH OF THE  
SACRAMENTO-SAN JOAQUIN DELTA**

## Appendix D

### F I S H

#### Fish Species of the Sacramento-San Joaquin Delta

Modified from HERBOLD AND MOYLE, 1989.

Status abbreviations: SE = State Endangered, ST = State Threatened, SC = State Candidate for listing, CSC = California Species of Special Concern, FE = Federally Endangered, FT = Federally Threatened, FP = Federally Proposed for listing, FC1 = Federal Category 1 Candidate, FC2 = Federal Category 2 Candidate.

Abundance abbreviations: (R)=Resident, (A)=Anadromous, (M)=eryhaline marine.

<u>COMMON AND</u> <u>SCIENTIFIC NAMES</u>	<u>STATUS</u>	<u>ABUNDANCE</u> <u>IN DELTA</u>	<u>NATIVE (N)</u> <u>INTRODUCED (I)</u>
Pacific lamprey <i>Entosphenus tridentatus</i>	CSC	Common (A)	N
River lamprey <i>Lampetra ayres</i>		Uncommon (A)	N
White sturgeon <i>Acipenser transmontanus</i>		Common (A)	N
Green sturgeon <i>Acipenser medirostris</i>	CSC	Uncommon (A)	N
American shad <i>Alosa sapidissima</i>		Common (A)	I
Threadfin shad <i>Dorosoma petenense</i>		Abundant (R)	I
Steelhead <i>Oncorhynchus mykiss</i>	CSC	Common (A)	N
Pink salmon <i>Oncorhynchus gorbuscha</i>		Occasional (A)	N
Coho salmon <i>Oncorhynchus kisutch</i>		Rare (A)	N
Chinook salmon (four runs) <i>Oncorhynchus tshawytscha</i>	CSC (Spring-run), SE, FE (Winter-run),	Occasional to common (A)	N
Chum salmon <i>Oncorhynchus keta</i>		Uncommon (A)	N
Sockeye salmon <i>Oncorhynchus nerka</i>		Uncommon (A)	N
Longfin smelt <i>Spirinchus thaleichthys</i>	ST, FT	Uncommon (A-R)	N
Delta smelt <i>Hypomesus transpacificus</i>		Uncommon (R)	N
Thicktail chub <i>Gila crassicauda</i>		Extinct	N
Hitch <i>Lavinia exilicauda</i>		Common (R)	N
California roach <i>Hesperoleucus symmetricus</i>		Rare (N)	N
Sacramento blackfish <i>Orthodon microlepidotus</i>		Common (R)	N

Splittail	CSC, FP(T)	Uncommon (R)	N
<i>Pogonichthys macrolepidotus</i>			
Hardhead	CSC	Uncommon (N)	N
<i>Mylopharodon conocephalus</i>			
Sacramento squawfish		Common (R)	N
<i>Ptychocheilus grandis</i>			
Fathead minnow		Occasional (R)	I
<i>Pimephales promelas</i>			
Golden shiner		Common (R)	I
<i>Notemigonus crysoleucas</i>			
Goldfish		Common (R)	I
<i>Carassius auratus</i>			
Carp		Abundant (R)	I
<i>Cyprinus carpio</i>			
Sacramento sucker		Common (R)	N
<i>Catostomus occidentalis</i>			
Black bullhead		Common (R)	I
<i>Ictalurus melas</i>			
Yellow bullhead		Rare (R)	I
<i>Ictalurus natalis</i>			
Brown bullhead		Common (R)	I
<i>Ictalurus nebulosus</i>			
White catfish		Abundant (R)	I
<i>Ictalurus catus</i>			
Channel catfish		Common (R)	I
<i>Ictalurus punctatus</i>			
Blue catfish		Rare (R)	I
<i>Ictalurus furcatus</i>			
Inland silversides		Abundant (R)	I
<i>Menidia beryllina</i>			
Mosquitofish		Common (A-R)	I
<i>Gambusia affinis</i>			
Striped bass		Abundant (A-R)	I
<i>Morone saxatilis</i>			
Sacramento perch	CSC, FC2	Rare	N
<i>Archoplites interruptus</i>			
Bluegill		Common (R)	I
<i>Lepomis macrochirus</i>			
Redear sunfish		Common (R)	I
<i>Lepomis microlophus</i>			
Green sunfish		Common (R)	I
<i>Lepomis cyanellus</i>			
Warmouth		Uncommon (R)	I
<i>Lepomis gulosus</i>			
White crappie		Common (R)	I
<i>Pomoxis annularis</i>			
Black crappie		Uncommon (R)	I
<i>Pomoxis nigromaculatus</i>			
Largemouth bass		Common (R)	I
<i>Micropterus salmoides</i>			
Smallmouth bass		Uncommon (R)	I

<i>Micropterus dolomieu</i>		
Bigscale logperch	Common (R)	I
<i>Percina macrolepida</i>		
Yellow perch	Extirpated	I
<i>Perca flavescens</i>		
Tule perch	Common (R)	N
<i>Hysterocarpus traski</i>		
Yellowfin goby	Common (R)	I
<i>Acanthogobius flavimanus</i>		
Staghorn sculpin	Common (M)	N
<i>Leptocottus armatus</i>		
Starry flounder	Common (M)	N
<i>Platichthys stellatus</i>		
Rainwater killfish	Rare (R)	I
<i>Lucania parva</i>		
Prickly sculpin	Common (R)	N
<i>Cottus asper</i>		
Threespine stickleback	Uncommon (R)	N
<i>Gasterosteus aculeatus</i>		
Chameleon goby	Common (R)	I
<i>Tridentiger trigoncephalus</i>		

**APPENDIX E**

**SACRAMENTO-SAN JOAQUIN DELTA  
SPECIAL STATUS SPECIES  
BIOLOGICAL DATA REPORTS**

# APPENDIX E

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## INTRODUCTION

This Appendix includes biological data reports for individual Special Status species known to exist or reasonably be expected to occur in the Sacramento-San Joaquin Delta and SB 34 work areas. The purpose of this Appendix is to present an overview of the special status species in the Delta. It provides accurate, up-to-date information on the distribution, habitat, and ecology of the pertinent species, as well as their known locations. The main goal of this report is to provide biological input for planning decisions and to serve as a framework for the more detailed biological assessments that will be required for specific project proposals.

It is beyond the scope of this report to provide site-by-site assessments of a project's potential impacts. It does, however, discuss potential impacts to species resulting from levee maintenance activities, in general, and their cumulative effects. There will be a need for site-specific studies for each work area and detailed mitigation plans for specific project proposals where impacts to species cannot be avoided.

### Definitions and Designations

The term "Special Status" species is a catch-all phrase and refers to species that are protected under the provisions of the Federal Endangered Species Act (ESA) and/or the California Endangered Species Act (CESA), and/or meet the definition of a rare or endangered species under Section 15380 of the California Environmental Quality Act (CEQA). The following is a brief description of the various lists and categories which directly refer to Special Status species:

#### Federal List - United States Fish and Wildlife Service (USFWS)

Endangered (E) - any species which is in danger of extinction throughout all or a significant portion of its range.

Threatened (T) - any species which is likely to become an endangered species in the foreseeable future throughout all or a significant portion of its range.

Proposed (P) - any species which is under review by the government to be listed as Endangered or Threatened.

Category 1 Candidate (C1) - taxa for which the USFWS has substantial information on species vulnerability and threats to propose listing as Threatened or Endangered.

Category 2 Candidate (C2) - taxa for which there is evidence of vulnerability, but not enough data is available to support a proposal for listing as Threatened or Endangered.



State List - California Department of Fish and Game (CDFG)

Endangered (E) - a native bird, mammal, fish, amphibian, reptile, or plant (species or subspecies) which is in serious danger of becoming extinct throughout all or a significant portion of its range due to loss or change of habitat, over-exploitation, predation, competition, disease, or other causes.

Threatened (T) - a native bird, mammal, fish, amphibian, reptile, or plant (species or subspecies) that, although not presently threatened with extinction, is likely to become an Endangered species in the foreseeable future in the absence of the special protection and management efforts required by the chapter.

Rare (R) - a native plant (species, subspecies, or variety), although not presently threatened with extinction, is in such small numbers throughout its range that it may become endangered if its present environment worsens. Since 1985 this designation applies to plants only.

Candidate (C) - a native bird, mammal, fish, amphibian, reptile, or plant (species or subspecies) for which the Fish and Game Commission has accepted a petition for review by the CDFG or for which it has published a notice to add it to its list of Endangered or Threatened species.

California Native Plant Society (CNPS)

List 1B - plants which are rare, threatened, or endangered throughout their range. All List B plants are vulnerable under present circumstances or have high potential of becoming so.

List 2 - plants which are rare, threatened or endangered in California but more widespread elsewhere.

Additional lists and categories that may meet the rare or endangered criteria under Section 15380 of the CEQA guidelines include the following: CDFG's species of special concern (SC), CNPS's List 3 and 4 plants, birds in the Audubon Blue List, and Federal Category 3 Candidate (C3) species. Biological data reports were not prepared for these species; however, CEQA encourages that they receive consideration for review as dictated by their actual rarity or degree of endangerment. This may require consulting with field experts, determining its importance locally, and examining the potential for controversy. Examples of such species in the Delta may include the Townsend's big-eared bat (*Plecotus townsendii*), pallid bat (*Antrozous pallidus*), double-crested commorant (*Phalacrocorax auritus*), northern harrier (*Circus cyaneus*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), burrowing owl (*Athene cunicularia*), loggerhead shrike (*Lanius ludovicianus*), or yellow warbler (*Dendroica petechia*).

## Methodology

A list of Special Status species was developed with information from the USFWS and CDFG. Species were added to or dropped from this list based on the likelihood of occurrence in the study area. For example, vernal pools are not part of the SB 34 work-area. Therefore, the Delta green ground beetle and Colusa grass were omitted. The western yellow-billed cuckoo was omitted due to the lack of cottonwood/willow riparian forest breeding habitat and distance from the nearest known breeding area.

Distributional and biological information were obtained from numerous reports in the files of the California Natural Diversity Data Base and the Sacramento Office of the USFWS. More recent information were sought through personal communications with local and regional experts, contacts with university personnel, status reports, theses, and personal field observations.

## Results and Discussions

The following are the written accounts of the biological data collected for the species of concern to this project. Included are 23 species (Table E-1): 8 plants, 5 birds, 2 mammals, 2 reptiles, 3 insects, and 3 fish. All 23 species have at least historic records within the project study area, and may be influenced by the immediate or long-term consequences of levee maintenance.

Included where available are photographs of the species, their preferred habitat, and maps of their known or estimated locations within the Sacramento-San Joaquin Delta study area. All photographs appearing in this document may not be reproduced for any purposes other than this report without prior approval from the photographer or organization.

TABLE E-1. Special Status Species of the Sacramento-San Joaquin Delta.

	COMMON NAME	SCIENTIFIC NAME	STATUS		
			USFWS	CDFG	CNPS
PLANTS	Suisun marsh aster	<i>Aster lentus</i>	C2	-	1B
	California hibiscus	<i>Hibiscus lasiocarpus</i>	-	-	2
	Delta tule pea	<i>Lathyrus jepsonii</i> var. <i>jepsonii</i>	C2	-	1B
	Mason's lilaeopsis	<i>Lilaeopsis masonii</i>	C2	R	1B
	Delta mudwort	<i>Limosella subulata</i>	-	-	2
	Antioch Dunes evening primrose	<i>Oenothera deltoides</i> ssp. <i>howellii</i>	E	E	1B
	Sanford's arrowhead	<i>Sagittaria sanfordii</i>	C2	-	1B
	Marsh skullcap	<i>Scutellaria galericulata</i>	-	-	2
BIRDS	Tricolored blackbird	<i>Agelaius tricolor</i>	C2	SC	-
	Aleutian Canada goose	<i>Branta canadensis leucopareia</i>	T	-	-
	Swainson's hawk	<i>Buteo swainsoni</i>	C3	T	-
	Greater sandhill crane	<i>Grus canadensis tabida</i>	-	T	-
	California black rail	<i>Laterallus jamaicensis coturniculus</i>	C2	T	-
MAMMALS	Salt-marsh harvest mouse	<i>Reithrodontomys raviventris</i>	E	E	-
	San Joaquin kit fox	<i>Vulpes macrotis mutica</i>	E	T	-
REPTILES	Western pond turtle	<i>Clemmys marmorata</i>	C2	SC	-
	Giant garter snake	<i>Thamnophis gigas</i>	T	T	-
INSECTS	Antioch Dunes anthicid beetle	<i>Anthicus antiochensis</i>	C2	-	-
	Sacramento anthicid beetle	<i>Anthicus sacramento</i>	C2	-	-
	Valley elderberry longhorn beetle	<i>Desmocerus californicus dimorphus</i>	T	-	-
FISH	Delta smelt	<i>Hypomesus transpacificus</i>	T	T	-
	Winter-run chinook salmon	<i>Oncorhynchus tshawytscha</i>	E	E	-
	Sacramento splittail	<i>Pogonichthys macrolepidotus</i>	P(T)	SC	-

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## PLANTS

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California hibiscus - DFG photo by Barry Baba

narrow adaptation to brackish water, compounded by the historic destruction of such tidally influenced habitats.

**Project Occurrence:**

The Suisun marsh aster is known from several areas throughout the Delta study area. It is mainly found along levees in the lower and central regions of the Delta. Plants have been recorded in pristine habitats along channel islands as well disturbed places such as on wooden pilings and riprapped banks.

**Project Impact:**

This species is distributed throughout much of the Delta, and is often found on levee banks where it could be directly affected by levee projects. Direct, short-term impacts to this species may include the loss of potential habitat and, possibly, individual plants. But because of its "weedy" nature, it could be expected to reestablish quickly in other areas. The long-term effects are difficult to determine, especially if other trends were to continue such as saltwater intrusion from water diversions and drought conditions. The Suisun marsh aster already appears to be primarily restricted certain water quality characteristics.

**Suisun Marsh Aster**  
(*Aster lentus* E. Greene)

**Status:**

The Suisun marsh aster is listed as a Category 2 Candidate species by the USFWS and designated as a List 1B plant by the CNPS.

**Description:**

The Suisun marsh aster is a tall (over 3 feet), slightly succulent perennial herb in the sunflower family (Asteraceae). Its leaves are long and narrow (1½ to 5 inches long); leaves are fewer and larger near the stem base. This aster produces several, conspicuous flowers from late May through November. Each flower consists of 20 to 40 purplish to whitish ray flowers around a central cluster of yellow disc flowers.

Although there are several closely related species, no other except *A. chilensis* occurs in marsh habitats. This species, however, is only 2 feet tall or less and occurs in more drier or saline situations. The Suisun marsh aster probably intergrades with other species, and, therefore, is not rare as a species, but just a particularly unusual form from this region (Hoover, 1937).

**Distribution:**

The Suisun marsh aster has an historic range which most likely included the margins of northern San Francisco Bay, Suisun Marsh, and the lower Sacramento-San Joaquin Delta. Its current distribution extends from Suisun Marsh east through the western and central regions of the Delta.

**Habitat:**

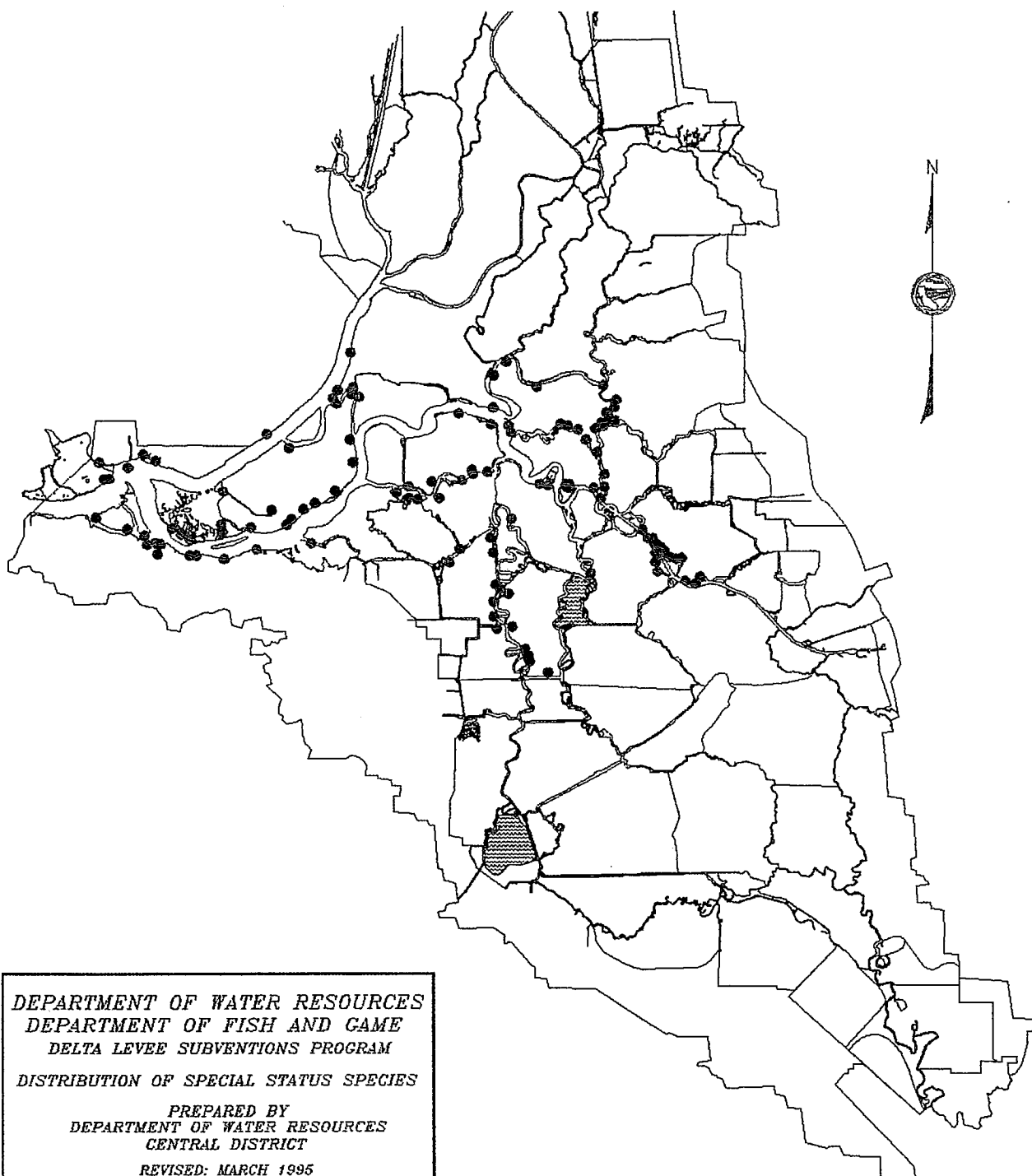
This species inhabits tidal streams and marsh areas throughout the lower Delta. It typically occurs along sloughs and riverbanks affected by tidal fluctuations, usually around the mid to high tide mark. Plants have been observed growing in pristine habitats among tules (*Scirpus* spp.) and in disturbed areas on wooden pilings and in riprap where it may appear as a common moist-habitat weed. No correlation between riparian and marsh species was observed for plant association preference for this species.

**Endangerment:**

Suisun marsh aster appears to be restricted to tidal marshes and, therefore, is possibly dependent upon certain water quality characteristics. Its narrow range of environmental conditions makes it vulnerable to changes in water quality. Its current rarity may be due to a

# SACRAMENTO-SAN JOAQUIN DELTA

● SUISUN MARSH ASTER SITES



**California Hibiscus**  
(*Hibiscus lasiocarpus* Cav.)

**Status:**

Although not listed by the USFWS or CDFG, the California hibiscus is designated as a List 2 plant by the CNPS.

**Description:**

California hibiscus, also known as Rose mallow, is a tall, herbaceous perennial plant in the mallow family (Malvaceae). It produces several stout, cane-like stems and forms a relatively robust bush up to 6 feet tall. Its heart-shaped leaves are large (2 to 6 inches across), velvety green to gray in color, and pubescent. Large, showy white flowers with deep red centers bloom late in season, usually in August and September.

**Distribution:**

This plant has a range which extends from approximately the lower Butte Creek area north and west of Marysville Buttes, to the lower portions of the Sacramento and San Joaquin rivers of the Delta. Most records have been from the Sacramento-San Joaquin Delta region.

**Habitat:**

California hibiscus grows in well-developed freshwater marsh areas, moist riverbanks, and on low peat islands of the Delta. It has also been observed in undisturbed backwaters such as ponds and irrigation canals where other marsh vegetation grows (CNPS, 1977). It is not known to occur along river channels which are characterized by strong currents, intense flood forces, or steep banks. Although it occurs in areas of the Delta which are influenced by tidal fluctuations, it appears to be restricted to freshwater habitats.

Common associated floodplain species include tules (*Scirpus* spp.), cattails (*Typha* spp.), willows (*Salix* spp.), dogwood (*Cornus sericea* ssp. *sericea*), smartweed (*Polygonum* spp.), and blackberries (*Rubus* spp.).

**Endangerment:**

This species is uncommon primarily because it has been eliminated from many sites within much of its historic range through alteration of its habitat by public works improvements, specifically erosion and flood control projects, and weed eradication (CNPS, 1977). Historic levee construction and ongoing levee maintenance along the Sacramento River and in the Delta have eliminated much of the species' preferred gradual moist bank and island edge environments, while agricultural development and marsh reclamation have altered or destroyed many of the backwater and high marsh communities where it once grew.



Although its historic depletion is largely due to wetland reclamation, weed control, and riverbank alterations, it may also be threatened, at least in the Delta, by increases in water salinity due to increased water diversions and recent drought conditions.

**Project Occurrence:**

California hibiscus grows throughout the less saline areas of the Delta. For the most part, it is found on undisturbed channel islands and pristine shorelines of levee banks. However, it has also been found occasionally along older rip-rapped banks and on the interior of islands where irrigation canals and seep ditches provide suitable habitat.

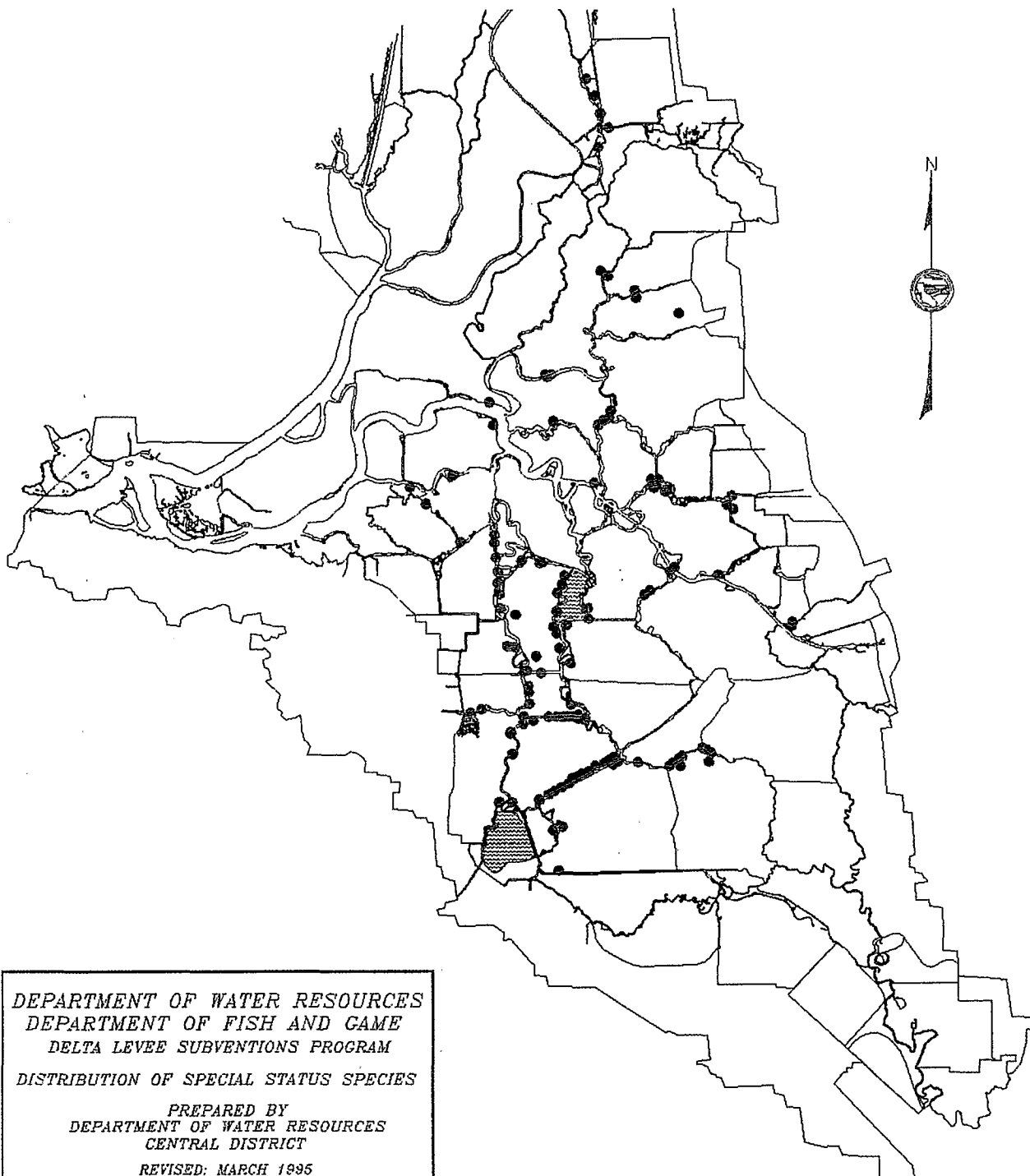
**Project Impact:**

California hibiscus grows in many places within the project area. Although no major populations are known to exist along levee banks, potential impacts to the species may include an immediate alteration of marginally suitable habitat, and the destruction of perhaps a few locations where good habitat and, possibly, a few individuals occur. This could result in the reduction of potential future colonizing sites and an overall reduction in the species' total available habitat.

Significant adverse impacts to existing populations may also occur if any projects involve disturbance to any of the channel islands. The species appears to be highly sensitive to habitat modifications that result in improved drainage and increased oxygen tensions in the soil that allow influx of "weedy" plant species.

# SACRAMENTO-SAN JOAQUIN DELTA

● CALIFORNIA HIBISCUS SITES



**Delta Tule Pea**  
(*Lathyrus jepsonii* E. Greene var. *jepsonii*)

**Status:**

The Delta tule pea is listed as a Category 2 Candidate species by the USFWS and regarded as a List 1B plant by the CNPS.

**Description:**

The Delta tule pea is a member of the pea family (Fabaceae). This trailing, vine-like perennial herb is typically found at the water's edge. It produces several stems up to 8 feet long, and often wraps around other plants for support or produces large tangled masses if no other vegetation is available. Pink to lavender flowers bloom in bunches from May through July. Its fruit is a peapod which reaches lengths of up to 4 inches. A key distinguishing character of this species is its broadly winged stems.

Questions have been raised concerning the taxonomic validity of separating variety "*jepsonii*" and "*californicus*" (a widespread taxon), because several mixed populations of both varieties can occur. A key distinguishing character of variety "*jepsonii*" is the lack of pubescence on its stems and leaves. In many related taxa, this is considered a minor variation not worthy of formal taxonomic recognition. However, variety "*jepsonii*" is restricted mainly to marshes and adjacent rivers as compared with the drier upland habitat of variety "*californicus*".

**Distribution:**

The current geographical range of the Delta tule pea is from the Napa River in Napa County to the Stockton area in San Joaquin County, and generally throughout the Delta, north to approximately Walnut Grove. Although it grows throughout most of the Delta system, it is not uniformly distributed.

Populations have also been found in various parts of the San Joaquin Valley; however, the placement of these specimens in this variety has been questioned (Hitchcock, 1952).

**Habitat:**

Delta tule pea grows in tidally influenced brackish and freshwater wetlands, including tule marshes, muddy riverbanks, sloughs, and occasionally along older rip-rapped banks. It is a trailing vine-like plant which either grows at the water's edge along river banks or on the higher grounds of marshlands. The tide rarely, if ever, completely covers this plant.

Common associated species in which it grows among include tules (*Scirpus* spp.), willows (*Salix* spp.), rush (*Juncus* spp.), and a variety of shrubs.

**Endangerment:**

Extensive diking and draining of wetlands in the Delta for agricultural and other purposes has affected and perhaps destroyed much of the plant's former habitat. Today, the Delta tule pea is threatened by changes in water quality, and may undergo even more population declines if water salinities continue to increase in the lower Delta. Other activities, such flood control projects, could also pose a significant threat to the species.

**Project Occurrence:**

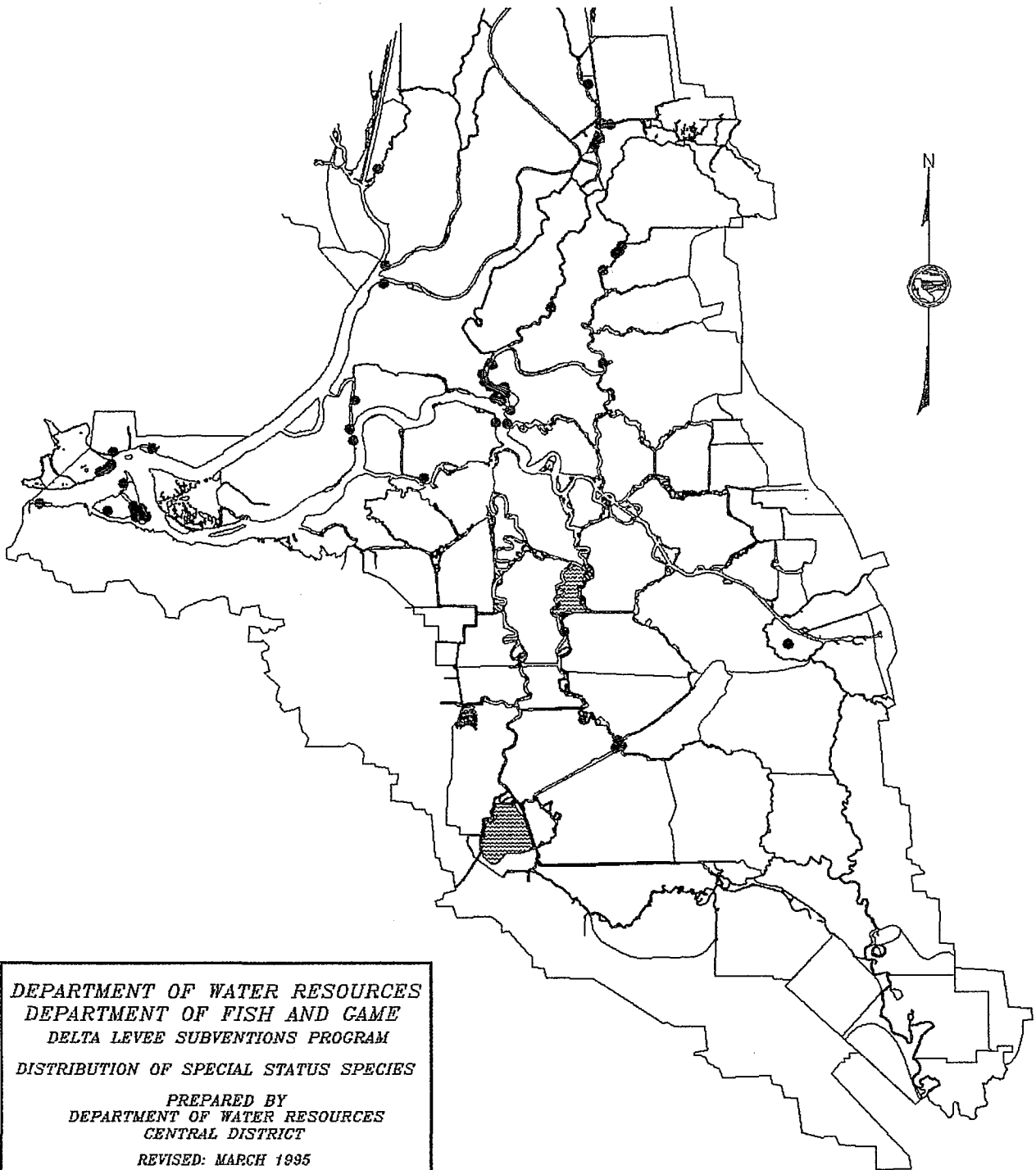
The Delta tule pea has been found throughout much of the Delta region. Populations have been found on both channel islands and levee banks, including older rip-rapped banks. Each occurrence may vary from isolated individual plants to patches covering over 50 feet of streambank. It appears that the plants are more abundantly found in, but certainly not restricted to, the lower regions of the Delta.

**Project Impact:**

This species may be affected both directly and indirectly due to levee projects in several ways. Since the plants are known to occur along the shorelines of rivers and sloughs throughout the Delta, the continued use and maintenance of the levee system could result in the direct loss of habitat and individual plants. Levee projects may also reduce habitat suitability and retard or discourage expansion of the plants into other areas of the Delta. The severity of this, however, is not currently known since extensive populations have been found along rip-rapped banks. The cumulative impacts of levee projects along with other trends (e.g., saltwater intrusion and water quality degradation) presumably could threaten the future existence of this plant.

# *SACRAMENTO-SAN JOAQUIN DELTA*

● *DELTA TULE PEA SITES*



**Mason's Lilaeopsis**  
(*Lilaeopsis masonii* Mathias & Constance)

**Status:**

Mason's lilaeopsis is designated as a Rare species by the CDFG, a Category 2 Candidate species by the USFWS, and a List 1B plant by the CNPS.

**Description:**

Mason's lilaeopsis, also known as mudflat quill, is a member of the carrot family (Apiaceae). It is a short, turf-forming perennial plant with bright green, quill-shaped leaves. From a distance, the plants appear almost lawn-like. Its leaves are usually less than 3 inches long, less than 1/8 inch wide, somewhat succulent, cylindrical in shape, and hollow. Distinct septations on the leaves are visible when held up to the light. Tiny white to greenish flowers are produced in short umbels from April through October.

The plants spread vegetatively by rhizomatous growth, and may also colonize new habitats by seed deposition (McCarten, 1989). Entire plants have been observed floating in the sloughs suggesting that vegetative reproduction may be important in colonization. It is likely that some populations are composed mostly of clones from individuals that initially colonized the habitat.

**Distribution:**

Mason's lilaeopsis was presumed extirpated in 1974 due to construction of the new Antioch Bridge and associated shoreline disturbance, but has since been re-collected and reported from many areas throughout the Delta. It is currently known from the Napa River, Suisun Bay, and Sacramento-San Joaquin Delta. The overall distribution of the plant includes Contra Costa, Napa, Solano, Sacramento, and San Joaquin counties. Some of the largest and healthiest populations have been reported from uninhabited islands in Suisun Bay where there is no riprap and little human disturbance (Fielder and Golden, 1990).

**Habitat:**

Mason's lilaeopsis is a semi-aquatic plant restricted to the water's edge where it is inundated by waves and tidal fluctuations. It is usually found between 4 to 28 inches above the low tide mark, and has been recorded growing in saline waters as high as 8.5 parts per thousand (Fielder and Golden, 1990). Populations tend to form sod mats along eroding banks and occasionally on rotting tree trunks and other similar objects. A few populations have also been observed growing in between rocks of riprap. Little is known about the plant's ecology in relation to inundation regimes, colonization of mineral substrate, and tolerance of, or requirements for, disturbance.

Species most commonly found in association with Mason's lilaeopsis include tules (*Scirpus* spp.), pennywort (*Hydrocotyle* spp.), pygmy weed (*Crassula aquatica*), and rush (*Juncus* sp.).

**Endangerment:**

Mason's lilaeopsis was historically known from only a few areas. It was thought to be extinct until new populations were discovered in 1977. Although its known distribution has become more widespread in recent years, it is still threatened in its western portions of its range by salt water intrusion, and elsewhere in the Delta by alteration and loss of habitat due to accelerated erosion and bank protection projects.

**Project Occurrence:**

Mason's lilaeopsis occurs throughout much of the Delta study area. It is an occasional plant along levees, but relatively common on channel berms and islands. It appears to be most abundant in the lower Delta, around Sherman and Brannan islands.

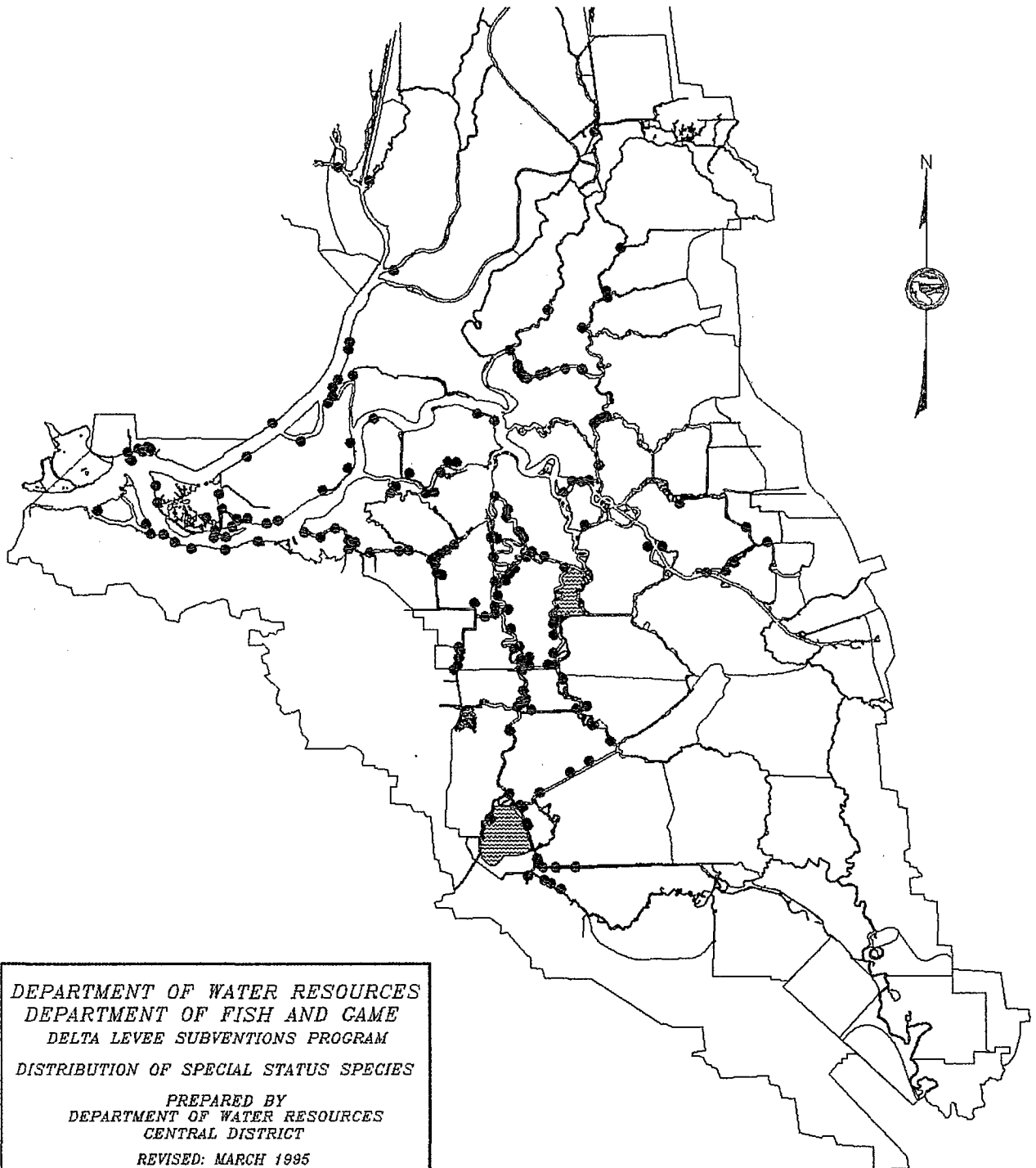
**Project Impact:**

Impacts to this species as a result of levee projects may be both direct and indirect, short-term and long-term. The apparent preference of Mason's lilaeopsis to reside in areas where bank erosion is a problem contributes to the species' endangerment since these areas are likely to be stabilized by riprap and other bank stabilization projects. Indirect and long-term impacts include the reduction of potential future colonizing sites and, therefore, an overall reduction in the species' total available habitat. This could become significant to the species if other trends were to continue (e.g., saltwater intrusion and water quality degradation).

It is most important that projects not involve disturbance to or alteration of any of the channel islands. Many of these islands represent some of the largest and healthiest populations in the Delta.

# SACRAMENTO-SAN JOAQUIN DELTA

● MASONS LILAEOPSIS SITES





**Delta Mudwort**  
(*Limosella subulata* Ives)

**Status:**

The Delta mudwort is not listed by the USFWS or CDFG, but is designated as a List 2 plant by the CNPS.

**Description:**

The Delta mudwort, a member of the figwort family (Scrophulariaceae), is a small, inconspicuous perennial plant which forms tufted mats growing from rhizomes. It superficially resembles Mason's lilaeopsis (*Lilaeopsis masonii*), but differs by having shorter leaves (¼ to 1 inch long) which lack septations. In addition, the flowers of this species can be readily differentiated from Mason's lilaeopsis. White flowers are produced on single stalks which appear from March through September. Newly colonized plants have been observed flowering as late as December.

Because the plants can reproduce vegetatively by rhizomes, some populations may be extensively composed of clonal colonies.

**Distribution:**

In California, this plant is known only from a few locations in the Sacramento-San Joaquin Delta. It may also be known from the Atlantic coast where it is considered a rare plant (Bittman, pers. comm.). Currently, the Delta mudwort appears to be more narrowly distributed than Mason's lilaeopsis.

**Habitat:**

The habitat of this plant is very similar to that of Mason's lilaeopsis. It grows along eroding banks which are inundated during each tidal cycle. Populations are found most frequently along the edges of channel islands where competition with other species is limited. Little information is available on the plant's tolerance to brackish water.

Common associated species include tules (*Scirpus* spp.), miniature spikerush (*Eleocharis acicularis*), pigmy weed (*Crassula aquatica*), pennywort (*Hydrocotyle* spp.), smartweed (*Polygonum* spp.), Mason's lilaeopsis, and rush (*Juncus* spp.).

**Endangerment:**

This species is threatened due to trampling, erosion by wave action, and possibly sea level rising and water quality degradation. The extent of the plant's distribution, however, needs further study.

**Project Occurrence:**

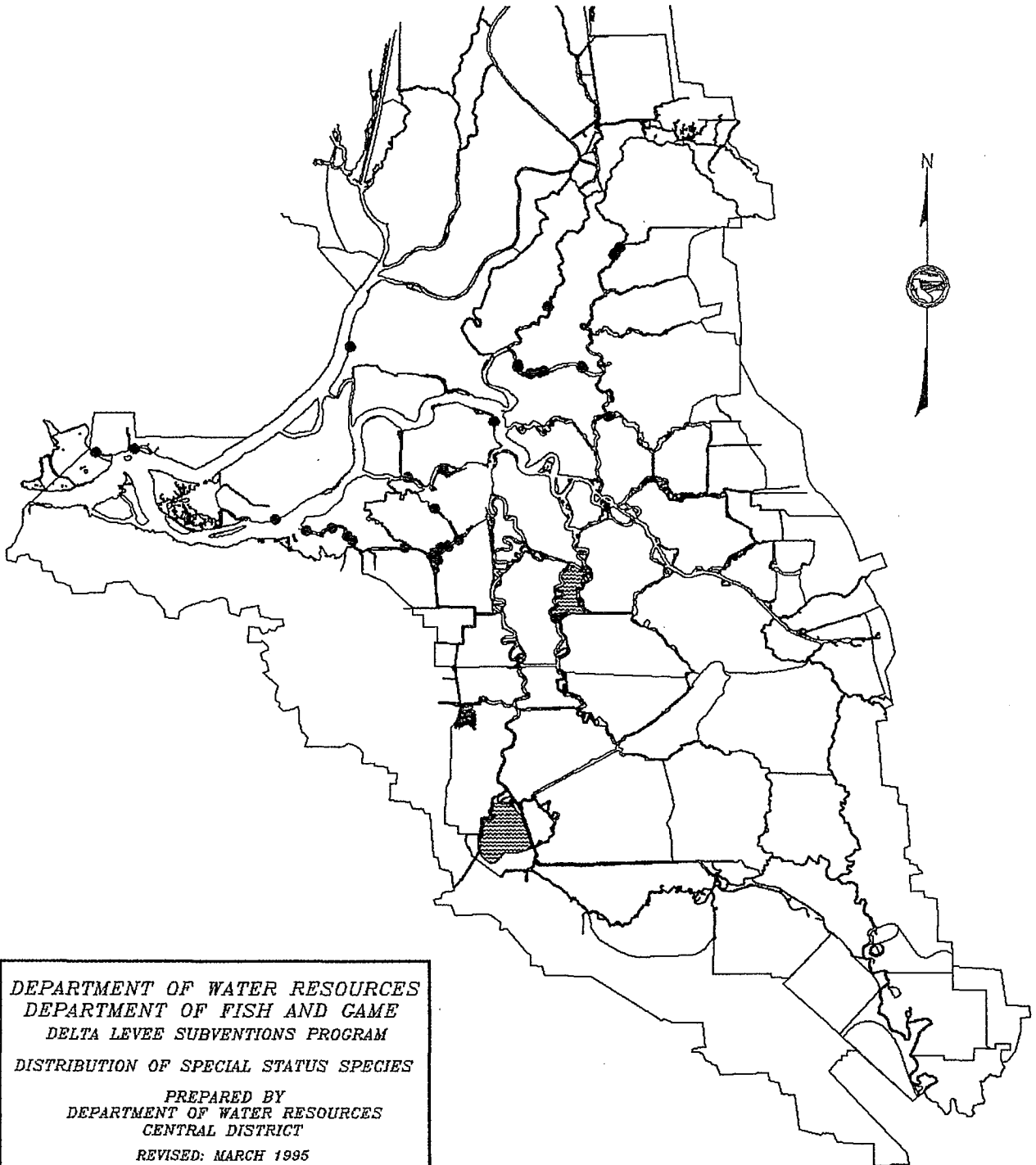
The Delta mudwort is known from scattered areas throughout the Delta. Most populations have been found along channel islands, but a few have been recorded along levee banks where habitat conditions are suitable. This plant, like Mason's *lilaeopsis*, may also establish on wooden pilings or rotting tree trunks.

**Project Impact:**

Potential impacts to this species as a result of levee projects are similar to that of Mason's *lilaeopsis*. Its habitat preference for eroding banks which are often in need of stabilization contribute's to the species endangerment since these areas are likely to be altered to habitat conditions no longer suitable for the species. Levee projects could also result in the loss of potential future colonizing areas and, therefore, an overall reduction in the species' total available habitat.

# SACRAMENTO-SAN JOAQUIN DELTA

● DELTA MUDWORT SITES



**Antioch Dunes Evening Primrose**  
*Oenothera deltoides* Torrey & Frémont ssp. *howellii* (Munz) Klein

**Status:**

The Antioch Dunes evening primrose is designated as an Endangered species by both the USFWS and CDFG.

**Description:**

This species belongs to the evening primrose family (Onagraceae). The Antioch Dunes evening primrose is an herbaceous perennial plant that grows up to 2.5 feet tall. This "short-lived" perennial forms low, densely-branched bushes, and produces rather large, white or pinkish flowers that bloom from March through May and briefly in September. Its leaves are grayish, pubescent, lance-shaped, and strongly toothed. The flowers of this plant open in the early evening and usually close by mid-morning.

In cultivation it has proved to be a biennial. Roof (1969) described the life history of this plant as follows: "new seedlings develop vigorously, spread to about a foot in width, and bloom in their first spring; in their second year they spread to 3 to 4 foot widths, bloom profusely, and die the following winter." Roof (1969) also noted that a few individuals survived longer and flowered in later years; however, these plants were not in very good condition.

**Distribution:**

The historic range of the Antioch Dunes evening primrose cannot be accurately determined from existing records, but probably included many river and slough-bank sand dunes in the Delta. Its total historic habitat acreage is estimated at 500 acres (USFWS, 1980). It currently inhabits approximately 60 acres at the Antioch Dunes National Wildlife Refuge in Contra Costa County and 5 acres at the Brannan Island State Recreation Area in Sacramento County. It occurs naturally at the Antioch Dunes; populations at Brannan Island were introduced from seeds. Small colonies were also started at Point Reyes National Seashore in Marin County and on Brown's Island in Contra Costa County, however, these populations are assumed to be extirpated.

**Habitat:**

The Antioch Dunes evening primrose is endemic to the riverine sand dunes of the lower Delta. It grows well in both loose and stabilized sand, but prefers freshly deposited, wind-blown sand. It requires freshly disturbed sand for the survival of succeeding generations, and is not found in heavily vegetated areas where seedlings cannot become established.

**Endangerment:**

The endangerment of this subspecies is the continued destruction of its sand dune habitat by industrial and agricultural development, sand mining, weed control, fire control practices, and other human activities. Weedy grasses are invading much of the remaining populations, including the ones on Brannan Island. There is also evidence which suggests that the reduction in the number of insects which pollinate the evening primrose may contribute to the lack of reproductive success of this species. Its small population size and distribution leaves it vulnerable to extinction.

**Project Occurrence:**

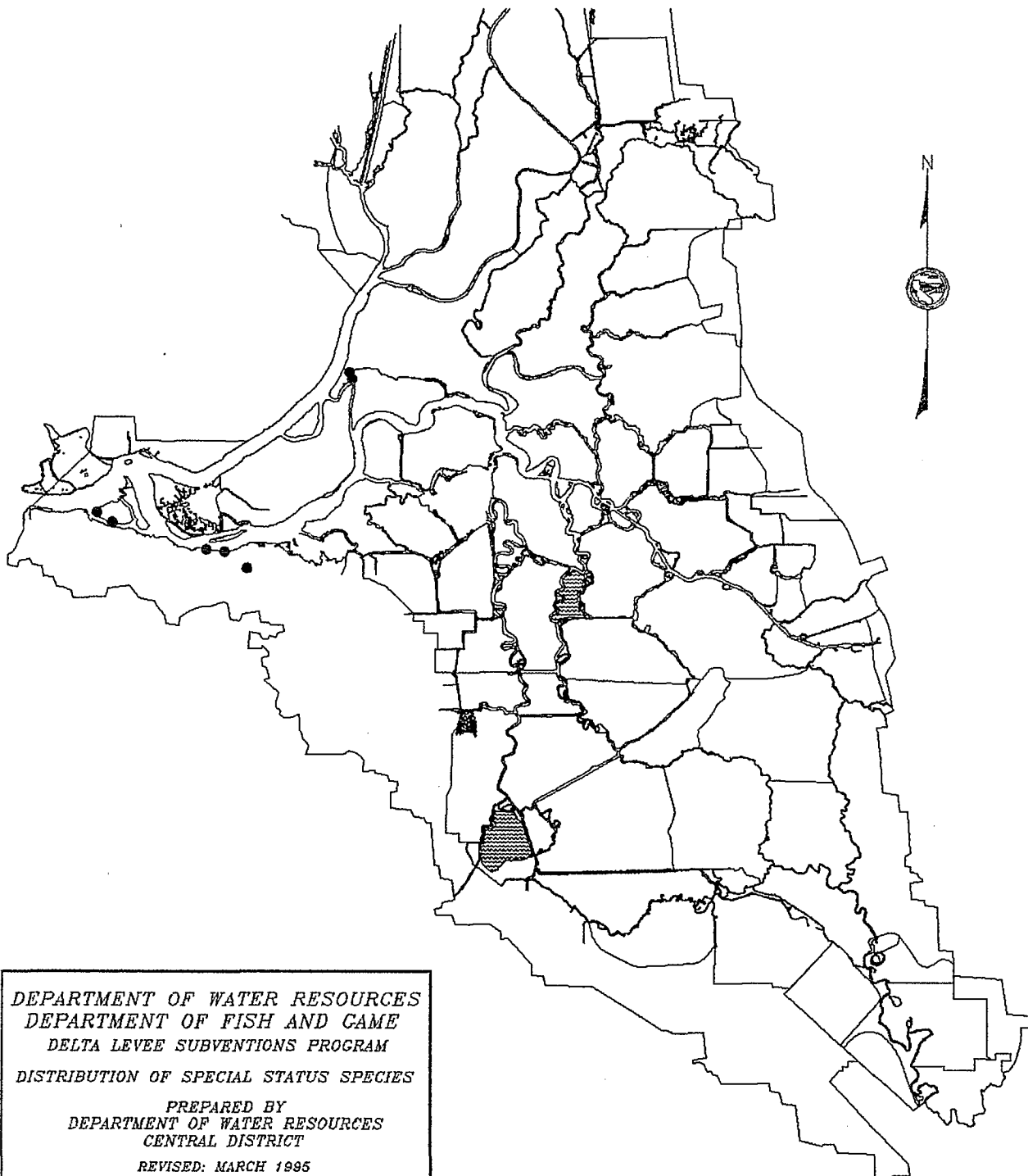
Although the Antioch Dunes evening primrose occurs within the Delta study area, it is not known from any SB 34 work areas. Its occurrence on Brannan Island is part of the Brannan Island State Recreation Area and is not part of the SB 34 program. Other dune sites in the Delta, for the most part, have been converted to agriculture or industrial uses, rendering the habitat unsuitable for the species.

**Project Impact:**

SB 34 projects are not expected to affect the Antioch Dunes evening primrose. Although its occurrence on Brannan Island is very near the study area, it is not part of the SB 34 work area and is not expected to be affected by the SB 34 program.

# *SACRAMENTO-SAN JOAQUIN DELTA*

● *ANTIOCH DUNES EVENING PRIMROSE SITES*



**Sanford's Arrowhead**  
(*Sagittaria sanfordii* E. Greene)

**Status:**

Sanford's arrowhead is listed as a Category 2 Candidate species by the USFWS and regarded as a List 1B plant by the CNPS.

**Description:**

Sanford's arrowhead is an emersed or partially submerged aquatic perennial herb in the water-plantain family (Alismataceae). The mature leaves of this plant are long and narrow, or less commonly elliptic, rather than arrow-shaped. This is considered to be a unique characteristic among the *Sagittaria* species in California. It is monoecious with female flowers located basally to male flowers on the same inflorescence. Many inflorescence are produced by the same plant throughout a given growing season. Each flower consists of three green sepals and three white petals. It blooms from May through October.

It reproduces by both seed production and asexually by stolons throughout the summer, and by tuber formation in the fall (Turner, 1982). Some populations are probably the result of one genetic individual due to its high rate of vegetative reproduction and low rate of seedling establishment.

**Distribution:**

Sanford's arrowhead is endemic to California. Most historical populations have been from the Central Valley. It is currently known from Butte, Fresno, Sacramento, San Joaquin, and Del Norte counties. Many former areas (Merced, Ventura, and San Joaquin counties) are presumed extirpated.

**Habitat:**

Sanford's arrowhead is a widespread but infrequent aquatic plant usually found growing along ponds, ditches, marshes, sloughs, or slow moving streams with silty or muddy substrates. The plants are usually found in shallow water, either partially or completely submerged. Most historical populations are from non-pristine habitats (e.g., ditches).

**Endangerment:**

There are relatively few historical populations of this plant, and most have been extirpated. It is currently threatened due to "development" pressures, particularly in the Central Valley. Its expected low genetic diversity also makes it susceptible to biological stresses. The extent of the plant's rarity and endangerment, however, are in need of further study.

**Project Occurrence:**

There are only two records of this species for the Delta. One population was found on a point bar in Steamboat Slough and the other along a channel island in the North Fork Mokelumne River between Staten and Tyler islands (ECOS, 1990a). The two locations represent range extensions for the previously known distribution of the species. There are no records of this species along any of the nonproject levees to date.

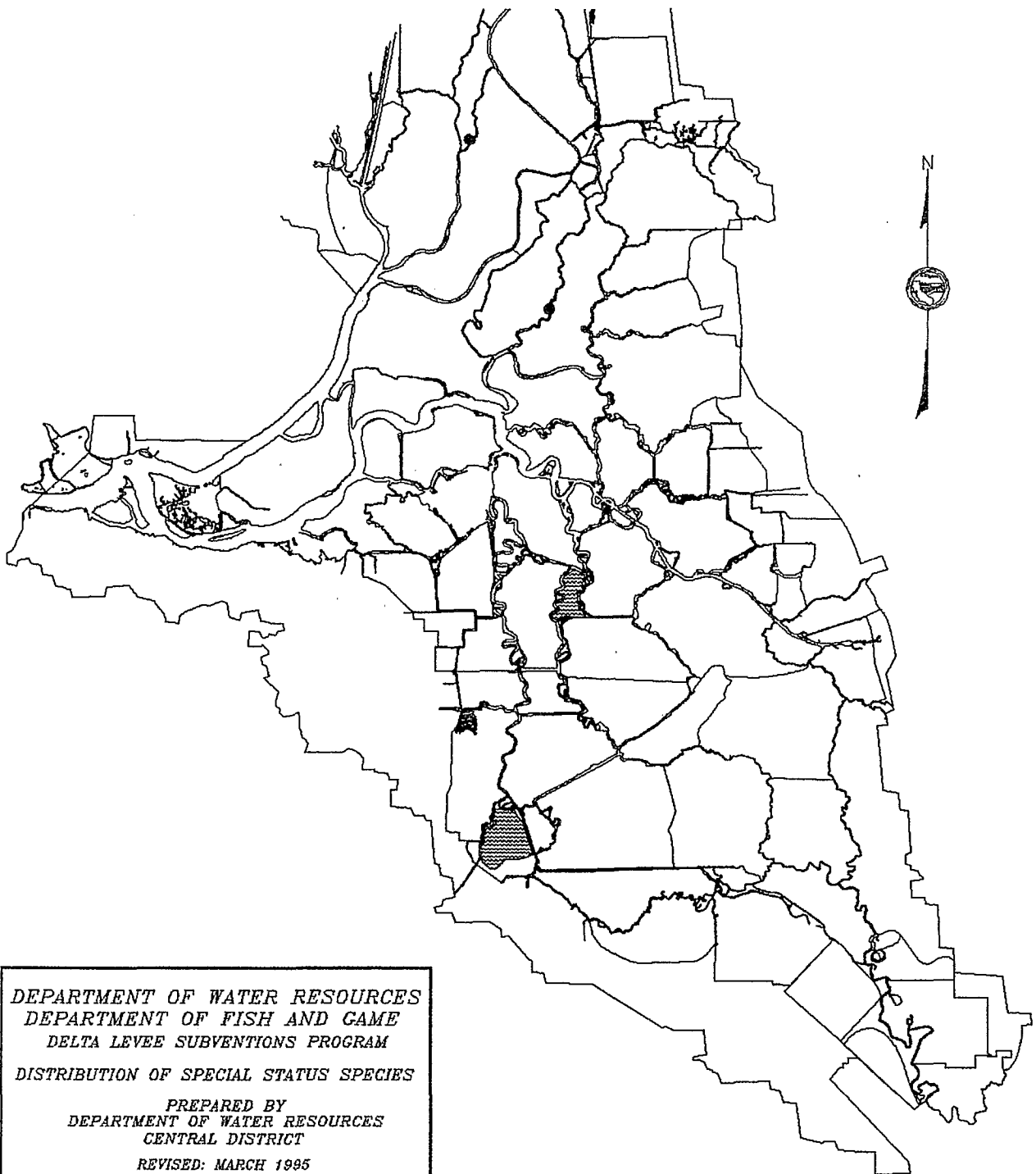
**Project Impact:**

It is unlikely that SB 34 levee projects would result in any significant impacts to this species. Its most likely occurrence in the Delta would be along channel islands, berms, ditches, and lagoons where high water flows and wave action are minimal. SB 34 mitigation or demonstration projects involving these areas, however, should be thoroughly evaluated to insure that no significant impacts to the species are incurred as a result of project implementation. It is important that the population along the channel island in the North Fork Mokelumne River not be disturbed as it was estimated in the thousands of individuals (ECOS, 1990a).



# *SACRAMENTO-SAN JOAQUIN DELTA*

● *SANFORD'S ARROWHEAD SITES*



**Marsh Skullcap**  
(*Scutellaria galericulata* L.)

**Status:**

Marsh skullcap is not listed by the USFWS or CDFG. It is, however, designated as a List 2 plant by the CNPS.

**Description:**

Marsh skullcap is an ascending perennial herb in the mint family (Lamiaceae). It is a spreading or weakly erect plant which produces solitary violet-blue flowers in the axils of its upper leaves. Its square stems are slender and often spread across the moist ground where it sends down new roots from its nodes. Its leaves are opposite, sharply ovate, dark green, and remotely crenate. It blooms from June through October.

**Distribution:**

Marsh skullcap is widespread throughout North America, including California, Oregon, Washington, Canada, Alaska, and eastern U.S. (Olmstead, pers. comm.). In California it has rarely been found and is known only from the Lake Tahoe Basin of Placer and Eldorado counties, the Fall River Basin of Shasta County (Wilken, 1991), and the Sacramento-San Joaquin Delta.

**Habitat:**

This plant grows in freshwater marshes, swamps, and along moist streambanks. Very little information is available on its habitat preferences in the Delta, however, it can be expected to grow wherever moist conditions are present. Historical records from the Delta have been from channel islands. Common associated species include tules (*Scirpus* spp.), sedge (*Cyperus eragrostis*), rush (*Juncus* spp.), and smartweed (*Polygonum* spp.).

**Endangerment:**

Although marsh skullcap is considered to be more widespread elsewhere, the actual distribution of this species in California is poorly known. Additional information is needed on the species' distributional range and sensitivity to habitat disturbance. Potential threats include flood control projects and other modifications to its habitat.

**Project Occurrence:**

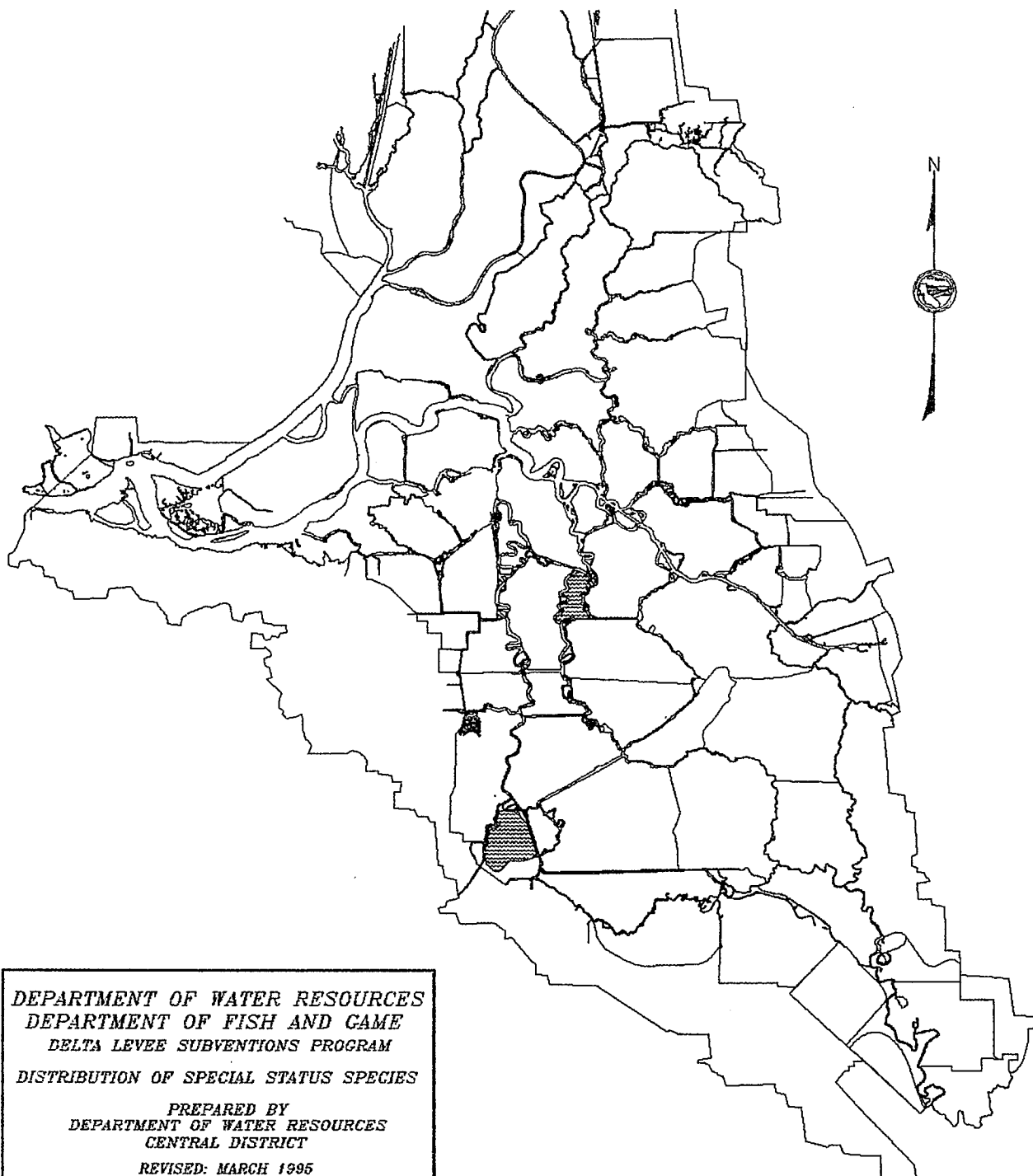
This species has been reported only from three areas in the Delta. It is presently known only from a channel island in the South Fork Mokelumne River between Staten and Bouldin islands.

**Project Impact:**

Very little information is available at this time to determine potential impacts to this species as a result of SB 34 projects. Although it has never been documented along levee banks, continued maintenance of the levee system could reduce potential colonizing areas. Additional information is needed on the species' sensitivity to habitat disturbance. It is important that the population in the North Fork Mokelumne River not be disturbed since it represents the only current population in the Delta.

# SACRAMENTO-SAN JOAQUIN DELTA

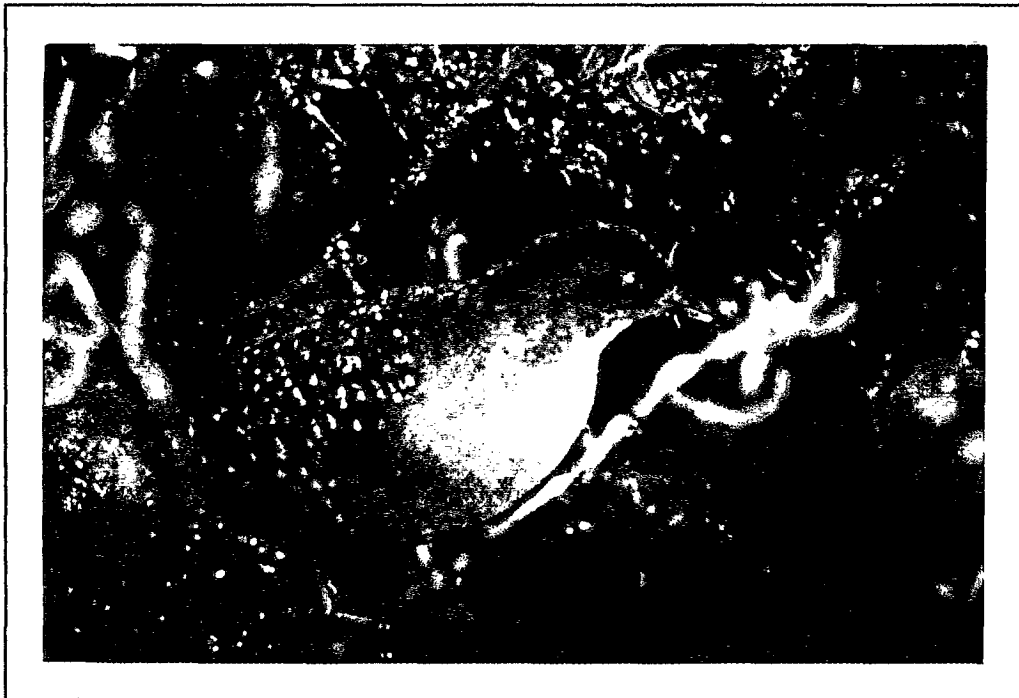
● MARSH SKULLCAP SITES



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## BIRDS

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California black rail - National Audubon Society photo © by P. Latourrette

**Tricolored Blackbird**  
(*Agelaius tricolor*)

**Status:**

The tricolored blackbird is designated as a Category 2 Candidate species by the USFWS.

**Description:**

The tricolored blackbird is one of four species of colonially nesting blackbirds in California. The basic body plumage of an adult male tricolor is glossy black with bright red epaulets or shoulder patches, which are broadly tipped with creamy white. Females are blackish gray and lightly streaked with brownish red.

Tricolors bear a strong resemblance to their abundant and widespread relative, the red-winged blackbird (*Agelaius phoeniceus*). However, whereas the epaulets of the male red-wing are scarlet or scarlet orange with yellow, in the male tricolor these feathers are red with creamy white. Female tricolors tend to appear somewhat darker and more uniformly blackish grey than female red-wings. Despite their similar appearance and overlap of ranges, tricolors are an entirely distinct species from red-winged blackbirds and will not hybridize with them.

**Distribution:**

Tricolored blackbirds are categorized as permanent residents of lowland California and are largely endemic to the state. They also occur sparsely in Oregon and possibly northwestern Baja California. Breeding colonies tend to concentrate primarily in the Sacramento and San Joaquin valleys.

**Habitat:**

Tricolors are highly colonial and nomadic birds which typically inhabit open valleys and foothills. Preferred nesting habitat has traditionally been emergent freshwater wetlands with reliable water sources supporting dense stands of cattails (*Typha* spp.), tules (*Scirpus* spp.), or willows (*Salix* spp.), as well as an abundant supply of terrestrial insects. Nesting has also been reported in other types of wetland and low-lying vegetation such as blackberries, thistles, mustard, and nettles (Beedy et al., 1991). Most nests are bound to upright plant stems from a few inches to a few feet above water or ground, and some occasionally being built on the ground (Neff, 1937).

Apparently, tricolors have the highest nesting density of any blackbird in North America. A typical colony size can vary from a minimum of about 50 nests (Grinnell and Miller, 1944) to over 20,000 in an area of 10 acres or less (DeHaven et al., 1975). Colonies were even larger

in former decades. Today, the average colony size is fewer than 1,000 adults (Beedy et al., 1991).

Territorial behavior is not considered a factor at limiting colony size since individual nests are often built within a foot of each other (Neff, 1937; Orians, 1961). Instead, the size of colonies seems to be related to the availability of food (Orians, 1961). Close proximity to freshwater and an abundant supply of terrestrial insects to exploit as food for nestlings are important in nest site selection. Insect matter (beetles, larvae, grasshoppers, and various flies) provide a major food source for tricolors during the breeding season. In winter, they forage mostly on vegetable matter (oats, rice, and other seeds and grain).

#### **Life History:**

Tricolors usually begin nest building in April, and breeding continues through mid-July (Dehaven et al., 1975). Orians (1960) also reported active breeding in October and November in the Sacramento Valley, although colonies nesting in this period were not very successful. Approximately four to five days are needed to build a nest, three to four days for egg laying, and about eleven days to incubate the eggs. Nestlings are able to leave the nest approximately twelve to fourteen days after hatching, for a total brood attention of just over one month (Payne, 1965).

Tricolors are polygynous with an average sex ratio of two females for every male. During the nonbreeding and winter season, tricolors may travel the entire length of the Central Valley and forage in large, nomadic flocks.

#### **Endangerment:**

The elimination of wetland habitat, which has drastically reduced available nesting and foraging habitat, is one of the primary reasons for the decline of tricolored populations. This has resulted in smaller colonies which are more vulnerable to disturbance by natural predators and also less able to compete with other species (e.g., the red-winged blackbird) for limited nesting habitat. Pesticides, poisoning (either deliberate or indirect), and increased disturbance by humans have also been cited as causes for reducing tricolored populations.

#### **Project Occurrence:**

Nesting tricolors are considered rare in the Delta study area, although they are frequently reported from the Davis, Sacramento, Elk Grove, and Stockton-Tracy areas. In winter, nomadic flocks interspersed with other blackbirds may converge in the Delta and in the northern San Joaquin Valley where the species can be fairly common (DeHaven et al., 1975).

**Project Impact:**

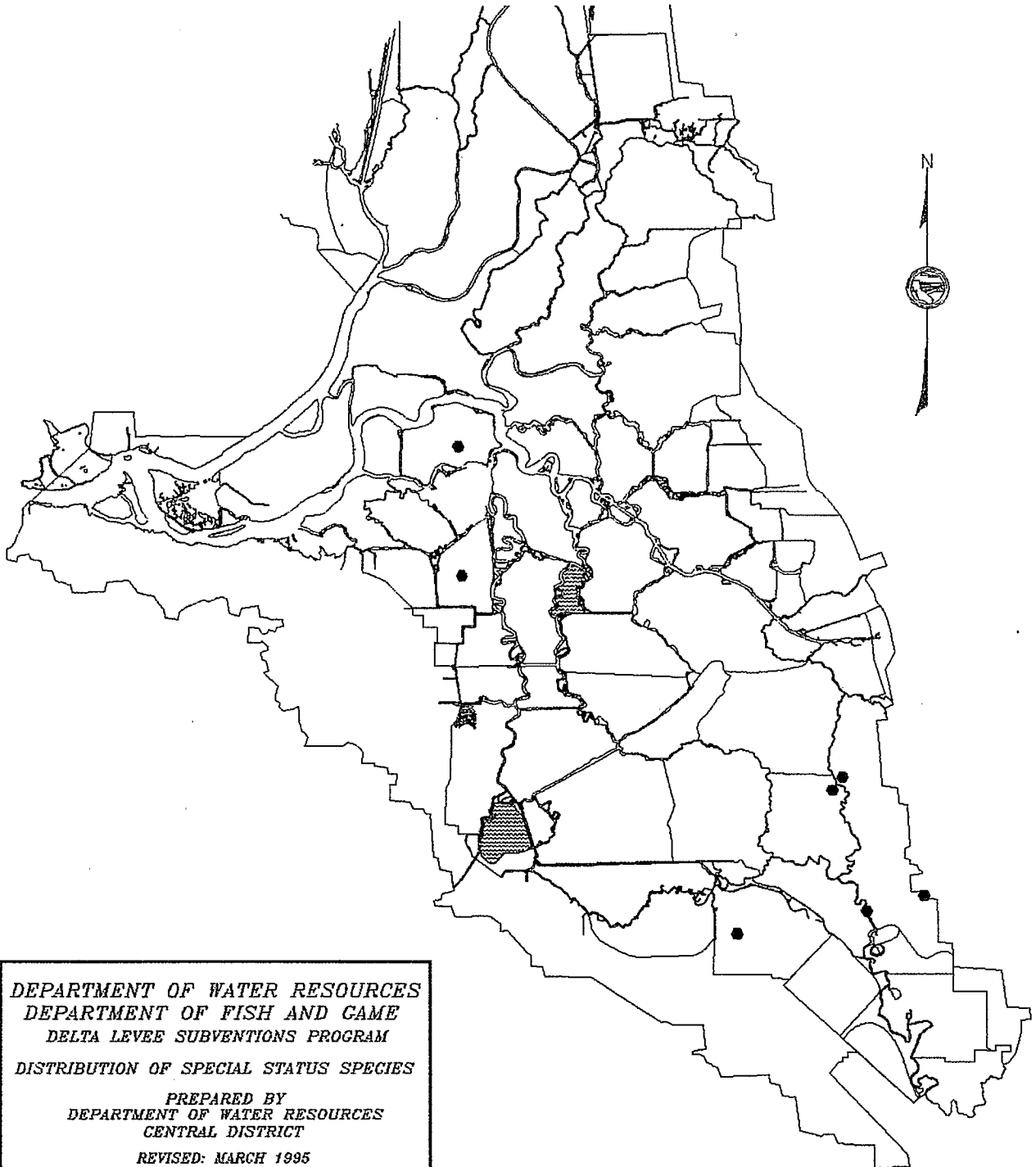
In general, SB 34 levee projects will not result in any direct losses of suitable nesting habitat for tricolors. Although suitable vegetation is present along many Delta levees, these stands are generally too small or too narrow to support any nesting colonies. It is important, however, that SB 34 projects not disturb any of the small, undeveloped islands situated in the main channels where suitable habitat is often present.

The overall impact on tricolored populations and use of the Delta are unknown. The availability of nesting and/or feeding habitats is a major factor which governs tricolored use of an area. If these areas are significantly reduced through levee projects, tricolored use could likewise be reduced.



# SACRAMENTO-SAN JOAQUIN DELTA

● TRI-COLORED BLACKBIRD SITES



**Aleutian Canada Goose**  
(*Branta canadensis leucopareia*)

**Status:**

The Aleutian Canada goose is currently listed as a Threatened species by the USFWS.

**Description:**

The Aleutian Canada goose, a Canada goose subspecies, is a small goose with a black head and neck and contrasting white chin strap. Its overall body color is light gray with white bordering the tips of its feathers. Underparts are white and the legs, tail, and beak are black to blackish gray. It can be distinguished from most other subspecies by its small size, abrupt forehead, and ring of white feathers around the base of the neck.

**Distribution:**

This distinct race of Canada goose subspecies breeds only in the Aleutian Islands and winters primarily in the Central Valley of California. Occasional winter migrants have also been reported in Japan. In California, four key winter use areas have been identified: Castle Rock in Del Norte County, the Butte Sink in the Sacramento Valley, the Faith and Mapes Ranches in Stanislaus County, and near Los Banos in Merced County.

**Habitat:**

On wintering grounds, Aleutian Canada geese prefer to forage in short-cropped, dry or irrigated pastureland and corn fields (Woolington et al., 1979). They have also been observed in marshes, rice stuble, and freshly sprouted wheat and barley fields (USFWS, 1980). The geese prefer to roost on land surrounded by water; however, they also roost on open water and occasionally in open pastureland.

Observational studies of the geese made on their wintering grounds in California have shown that they are very traditional in their use areas, returning to virtually the same feeding and roosting areas about the same time each year (Woolington et al., 1979). This habit has allowed precise determination of the bird's major use areas, timing of movements, and numbers present.

**Life History:**

Aleutian Canada geese leave their Alaska breeding grounds in September to winter in California. They begin arriving in the northern areas of California in October. The majority of the geese generally leave the northern Sacramento Valley use areas during late November or the first part of December and move south into the San Joaquin Valley. Peak numbers in

the Modesto area usually occur during the first two weeks of January. From the Modesto wintering area, the majority of geese move further south to the Los Banos area, where they generally remain until the last half of February or middle of March, when they return to the major spring staging area at Castle Rock in Del Norte County. The geese usually have all departed for their Aleutian breeding grounds by late April (USFWS, 1980).

**Endangerment:**

Aleutian Canada geese historically bred throughout the Aleutian Islands. With the introduction of arctic or blue foxes, the species was reduced to a breeding population of fewer than 800 birds in the 1960's. Other factors that contributed to the decline included hunting during migration in Alaska and on California wintering grounds, as well as the conversion or loss of wintering habitat.

Aleutian Canada geese populations have grown in recent years. This increase has been attributed primarily to reduced mortalities through hunting closures in the state's major migration and wintering areas, followed by similar protections in Alaska and Oregon. However, they are still threatened due to agricultural conversion of habitat and human disturbance.

**Project Occurrence:**

The Sacramento-San Joaquin Delta is not considered a major winter use area for the Aleutian Canada goose, but they have been observed in the region. For example, a group of 32 Aleutians was observed in a disked corn field on Andrus Island in January, 1990 (McNab and Springer, 1990). In that same month, two other banded Aleutians were shot in a disked corn field near Terminous Tract (McNab and Springer, 1990). Other reports of this species have included those on Staten, Wheeler, Bouldin, Venice, and Mandeville islands. Indications are, however, that these observations represent birds moving through the region to major wintering areas in the San Joaquin Valley, rather than the Delta actually serving as a major use area (Woolington et al., 1979, McNab and Springer, 1990).

**Project Impact:**

SB 34 levee projects are not expected to affect Aleutian Canada geese populations. No major wintering concentration grounds exist in the Delta, and, while the geese may occasionally forage in the area while moving to their major wintering grounds in the San Joaquin Valley, levee rehabilitation should not affect any known or potential winter use of the Delta islands.

lands devoted to crops such as corn, tomatoes, and sugar beets are not likely to support sufficient rodent populations to sustain a breeding pair of hawks (Estep, 1989).

Nests are usually located on the tops of trees. In the Central Valley, Bloom (1980) found a strong preference by the hawks for nesting in or near riparian habitats. Nesting densities are highest in riparian habitats associated with main river channels, and most nests are located within one mile of a riparian zone. Large, mature trees, such as valley oak (*Quercus lobata*), cottonwood (*Populus* spp.), walnut (*Juglans* spp.), willow (*Salix* spp.), and sycamore (*Platanus racemosa*) are the most frequently utilized trees (Bloom, 1980; Estep, 1989; Jones and Stokes, 1990). Nests have also been found occasionally in non-native trees such as eucalyptus (*Eucalyptus* spp.) and ornamental conifers.

Swainson's hawks are known to hunt aerially from about 100 to 300 feet above ground while searching for prey (Estep, 1989). They feed primarily on small mammals, although insects, birds, reptiles, and amphibians are occasionally taken. In the Central Valley, the California vole is probably the most frequently preyed upon.

#### **Life History:**

Swainson's hawks begin arriving in California from their wintering grounds in South America in early March, and remain in the state until October or November. Most breeding pairs begin nest construction and courtship activities soon after their arrival, with egg-laying occurring from late-March through April. Clutch sizes average from two to four eggs. The young leave the nest between June and August, about forty to forty-five days after hatching, but will remain with the parents and continue to be dependent upon them for food until they are ready for their migration in the fall.

During migration, Swainson's hawks typically travel in large flocks. Flocks of 100 or more birds were once common, but paralleling the population declines in California, observations of migrants in recent years have also declined. Swainson's hawks are monogamous and will remain so until the loss of a mate.

#### **Endangerment:**

The Swainson's hawk has apparently undergone one of the most severe population declines of any bird in California. The exact causes of this decline are unknown, but conversion of native grassland habitat to agriculture is considered the primary reason for the initial and continuing decline of populations in California (Detrich, 1986). Bloom (1980) also suggested that other unknown factors such as pesticide contamination, shooting during migration, and habitat deterioration on South America wintering grounds may also contribute to population declines.

**Swainson's Hawk**  
(*Buteo swainsoni*)

**Status:**

The Swainson's hawk is listed as a Threatened species by the CDFG.

**Description:**

The Swainson's hawk is a medium-sized buteo with a wing span of about 4 feet. Its basic body plumage varies considerably and occurs in three main color morphs: light, rufous, and dark, with intermediates. In dark phase birds, the entire body of the bird may be sooty black. Due to plumage variations and similarities to other buteos, identifying this hawk can sometimes be difficult. The Swainson's hawk is most easily distinguished from other buteos by its long, slightly upturned and pointed wings, characteristic dark band from the lower throat down to the upper breast, and distinctive underwing plumage pattern in which the lighter wing linings contrast with the darker flight feathers. The sexes are similar in appearance with the exception that females are slightly larger than males.

**Distribution:**

The Swainson's hawk breeds throughout western North America (northwestern Canada, western United States, and Mexico), migrates through Central America, and winters in the pampas areas of South America (Argentina, Uruguay, southern Brazil). In the Central Valley of California, the breeding range of the hawk extends from Tehama County in the north to Tulare County in the south. The largest remaining populations are described in the center of this range, in the Davis-Woodland-Sacramento area in the Sacramento Valley, and around the Stockton area in the San Joaquin Valley (Schlorff, pers. comm.). Breeding populations decrease steadily to the north and south of this region (Bloom, 1980).

**Habitat:**

Swainson's hawks nest primarily in riparian areas, but they may also use lone trees or groves of trees in agricultural fields, pastures, and near roads (Bloom, 1980). Important habitat parameters include adequate prey (primarily small mammals), open grasslands in which to forage, and occasional large trees which are suitable for nesting.

In the Delta and Central Valley region, large fields with low cover (to allow access to the ground) and an abundant prey base are the most frequently utilized for foraging and appear to be a major factor in determining Swainson's hawks presence or absence in certain areas. Suitable foraging areas include native grasslands, lightly grazed pastures, alfalfa and hay crops, as well as certain grain crops (Bloom, 1980; Estep, 1989). Although they have adapted to foraging in agricultural fields, not all crop types are suitable. Large tracts of agricultural

### **Project Occurrence:**

Swainson's hawks can be found throughout the Delta study area, but most nesting records are from the eastern and southeastern regions, such as New Hope Tract and Canal Ranch, where suitable foraging habitat is present. Nesting in the western and central regions of the Delta has been limited due to the lack of foraging habitat and severely diminished riparian woodland habitat. Occasional Swainson's hawks are also observed spending their winter months in the Delta as well (Schlorff, pers. comm.).

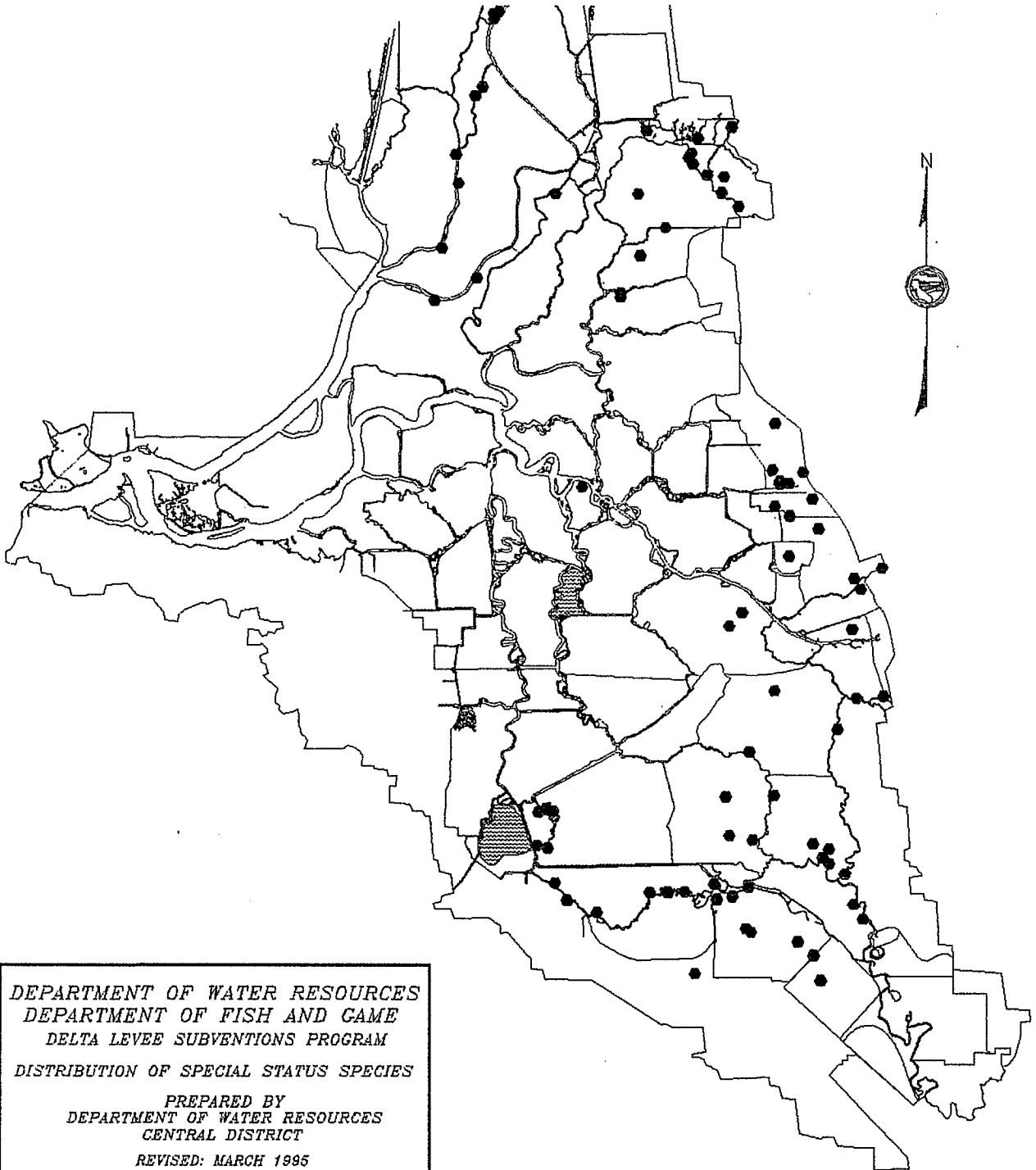
### **Project Impact:**

Currently, throughout most of the Delta, available foraging habitat, and not nesting habitat, appears to be the limiting factor. Levee projects may result in the direct loss of narrow zones of riparian woodlands or individual trees on existing levees, which can provide valuable nesting habitat for the Swainson's hawk. However, most of the lands on the Delta islands considered for this project are almost entirely under agricultural production for crops which are relatively unsuitable for the species. Most of the known nesting locations for the Swainson's hawk are located in the northern, eastern, and southern edges of the Delta and not on the major islands comprising the study area. While most of the islands have adequate nesting habitat (in the form of narrow riparian zones), available grassland or hayfield for foraging is extremely limited. On the periphery of the Delta where suitable foraging habitat exists (e.g., New Hope, Shin Kee, Rio Blanco, and Shima), protection of riparian nesting habitat should be of primary importance.

Levee projects, in general, may result in the long-term loss of suitable nesting habitat for the Swainson's hawk; however, the long-term effects are difficult to predict and are based primarily on future land uses on the Delta Islands.

# SACRAMENTO-SAN JOAQUIN DELTA

● SWAINSON'S HAWK SITES



**Greater Sandhill Crane**  
(*Grus canadensis tabida*)

**Status:**

The greater sandhill crane is classified as a Threatened species by the CDFG.

**Description:**

The greater sandhill crane is a long-legged, long-necked, gray bird with a white face and bare, reddish forehead. Both males and females are similar in appearance with the exception of their size, males are slightly larger.

The greater sandhill crane is the largest of six subspecies of sandhill cranes found in North America. Both the greater sandhill crane and, more common subspecies, lesser sandhill crane (*G. c. canadensis*) are found in the Sacramento-San Joaquin Delta. Greater sandhill cranes are most easily distinguished by their larger body size and longer bills. They can also be distinguished by their lower pitched calls, shape of their heads, and length of their bills relative to the size of their head (Pogson, 1990).

**Distribution:**

Greater sandhill cranes, which breed in scattered areas in British Columbia, eastern Washington, eastern and south-central Oregon, and northeastern California, migrate to wintering areas in the Central Valley of California. Greatest numbers of nesting cranes are found in Modoc County. Their most favorable wintering sites are the Butte Sink area of Butte County and the Thornton and Lodi areas of San Joaquin County.

Since both greater and lesser sandhill cranes intermix on wintering grounds in California, it is difficult to accurately estimate populations. The estimate for greater is between 3,400 and 6,000 individuals (DFG, 1992a). There are about 25,000 lesser sandhill cranes in California each year (DFG, 1992a). Roost counts indicate that greater sandhill cranes are more abundant from the Sacramento-San Joaquin Delta northward, while lesser sandhill cranes are more abundant from the Delta southward (Schlorff, pers. comm.).

**Habitat:**

On wintering grounds, sandhill cranes prefer to roost in shallow wetlands which are typically interspersed with or surrounded by low herbaceous or emergent vegetation. During the day, they fly short distances to feed. Rice is used extensively by cranes near the Butte Sink area (Pogson, 1990), and feeding within the Delta primarily occurs in harvested cornfields and nearby pastures. Pogson (1990) noted that preening was the most important activity of cranes in flooded fields, while foraging was an important activity in dry habitats.



Sandhill cranes establish nesting territories in wet meadows or shortgrass prairies which are often interspersed with emergent marsh. In California, nesting territories are most often found in open habitats, although in certain areas, nests are found in association with a dense cover of bulrush and burreed (Littlefield, 1989). Adults are omnivorous, but feed primarily on vegetable matter (small grains). They also consume frogs, mice, snakes, and crayfish.

#### **Life History:**

Greater sandhill cranes begin courtship and nesting in April. Most breeding occurs from May through July, and nesting is usually completed by late August. Their short winter migration usually begins in late September through early November. They migrate in large flocks to traditionally used wintering areas where the predominant crops are cereal grains (Lovvorn and Kirkpatrick, 1982). Most of the cranes use the Butte Sink region from October through November (Pogson, 1990). From December through January, the Thornton and Cosumnes regions in the Sacramento-San Joaquin Delta are the major use areas (Pogson, 1990).

#### **Endangerment:**

On breeding grounds, the availability of suitable nesting habitat is largely influenced by agricultural practices and weather conditions. Land conversions, prolonged drought conditions, high predation rates on both eggs and young, livestock grazing, disease, and mower-caused mortalities contribute to the threatened status of this subspecies. They are also being threatened by conversion of agricultural habitats, human disturbance, and collisions with power lines on wintering grounds.

#### **Project Occurrence:**

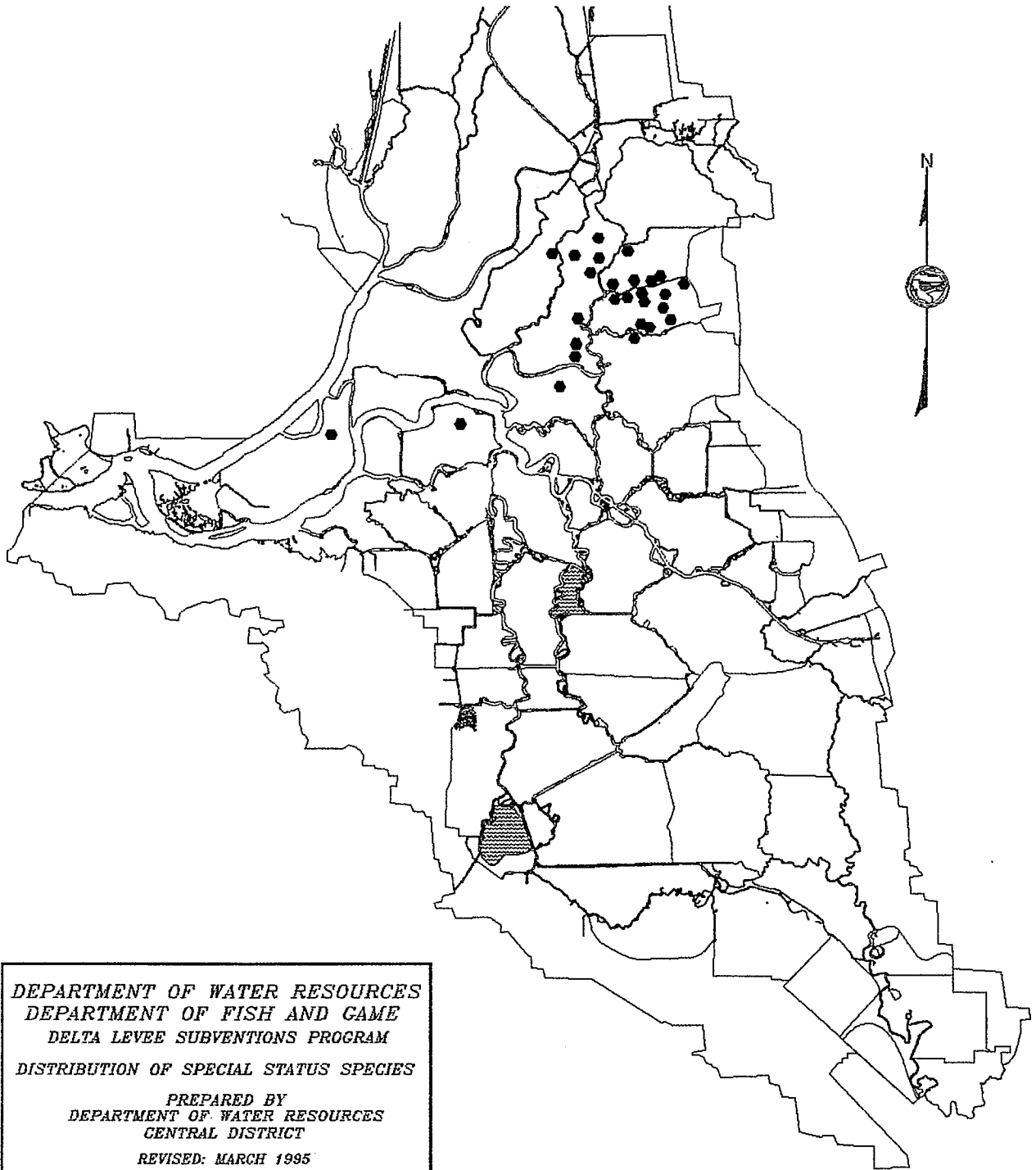
The greater sandhill crane winters primarily in the Central Valley of California, usually in the Butte Sink regions of the Sacramento Valley and in parts of the Sacramento-San Joaquin Delta. One of the most significant roosting areas within the Delta for populations of both greater and lesser sandhill cranes is near Thornton, in particular Brack Tract, Canal Tract, and Staten Island. Other common roosting areas include Tyler Island, Bouldin Island, and Terminous Tract. Isolated wintering populations have been observed on Sherman Island, Empire Tract, and King Island (Pogson, 1990).

#### **Project Impact:**

No significant impacts to sandhill cranes are expected as a result of SB levee projects. Although the Delta region is considered a major wintering area for the species, levee rehabilitation or maintenance is not expected to affect any known or potential winter use of the Delta islands. It is important, however, SB 34 mitigation projects not be located on sandhill crane wintering areas.

# SACRAMENTO-SAN JOAQUIN DELTA

● GREATER SANDHILL CRANE SITES



**California Black Rail**  
(*Laterallus jamaicensis coturniculus*)

**Status:**

The California black rail is designated as a Threatened species by the CDFG, and is a Category 2 Candidate species by the USFWS.

**Description:**

The California black rail is a little marsh bird about the size of a sparrow. General coloration is black to grey with faint white specks on the back and sides. A deep chestnut coloration is also present on the back of the neck. Juveniles differ by having a less distinctive pattern.

This rail is almost never seen, and biologists usually listen for its calls at dawn or dusk to confirm its presence. The repertoire of the black rail is composed of four distinct calls. The first, and most common, being a "kic-kic-kerr", repeated several times in succession, which is heard most extensively during the mating season. Other calls include a low growling "grr-grr-grr", "yelp", and "croo-croo-croo".

**Distribution:**

The California black rail is a year-long resident of tidal marshes in the San Francisco Bay area, Sacramento-San Joaquin Delta, coastal southern California at Morrow Bay, the Salton Sea, and lower Colorado River area. Formerly a local resident in coastal lowland marshes from Santa Barbara County to San Diego, it probably no longer breeds there. By all indications, most of the remaining concentrations of black rails occur in the marshes bordering San Pablo Bay and the Napa and Petaluma rivers (Evans and Page, 1985).

**Habitat:**

Black rails are known to inhabit saltwater, brackish water, and freshwater marshes. It most commonly occurs in tidal salt marshes dominated by pickleweed (*Salicornia* spp.) or brackish marshes supporting both pickleweed and bulrush (*Scirpus* spp.) (Wilbur, 1974; Manolis, 1977). During surveys by Manolis (1977) in the marshes around San Francisco Bay, black rails showed a definite preference for tidal marshes over non-tidal, diked marshes with similar vegetative characteristics. This preference is believed to result primarily from the higher productivity of invertebrate food resources resulting from tidal action. In the freshwater marshes of the Delta, the rails appear to prefer the high marshes dominated by bulrush and cattails (*Typha* spp.).

Rail nests are concealed in dense marsh vegetation, such as pickleweed, near the upper limits of tidal flooding. They consist of loosely-made, deep cups which may be at ground level or elevated several inches high (Wilbur, 1974; Repking, 1977).

Black rails are carnivorous. They glean and peck for a variety of arthropods (e.g., isopods and insects) from the surface of mud and vegetation.

#### **Life History:**

Information concerning the life history requirements and behavior of the California black rail is extremely limited due to their small size and secretive nature. Apparently black rails are yearlong residents with breeding occurring in spring. Nest desertion is reported to be common, especially if they are disturbed (Wilbur, 1974).

#### **Endangerment:**

The major threat to the existence of this rail is the loss and degradation of its habitat. In many areas, human-caused changes to marshland topography and vegetation has decreased the amount of suitable nesting habitat. Furthermore, losses of well-developed high marsh habitat also contributes to the black rail's exposure during extreme high tides, and subsequent predation by harriers, egrets, herons, short-eared owls, and feral cats.

#### **Project Occurrence:**

Due to extensive diking projects in the Delta, marsh habitat for this species occurs mainly on small, undeveloped islands located in the main channels of the sloughs and rivers. Examples of such islands can be found in Old River, Middle River, and White Slough. Other locations in the region where black rails have been observed include Columbia Cut, Whiskey Slough (Gifford, pers. comm.), Shin Kee Tract, and Mallard Island.

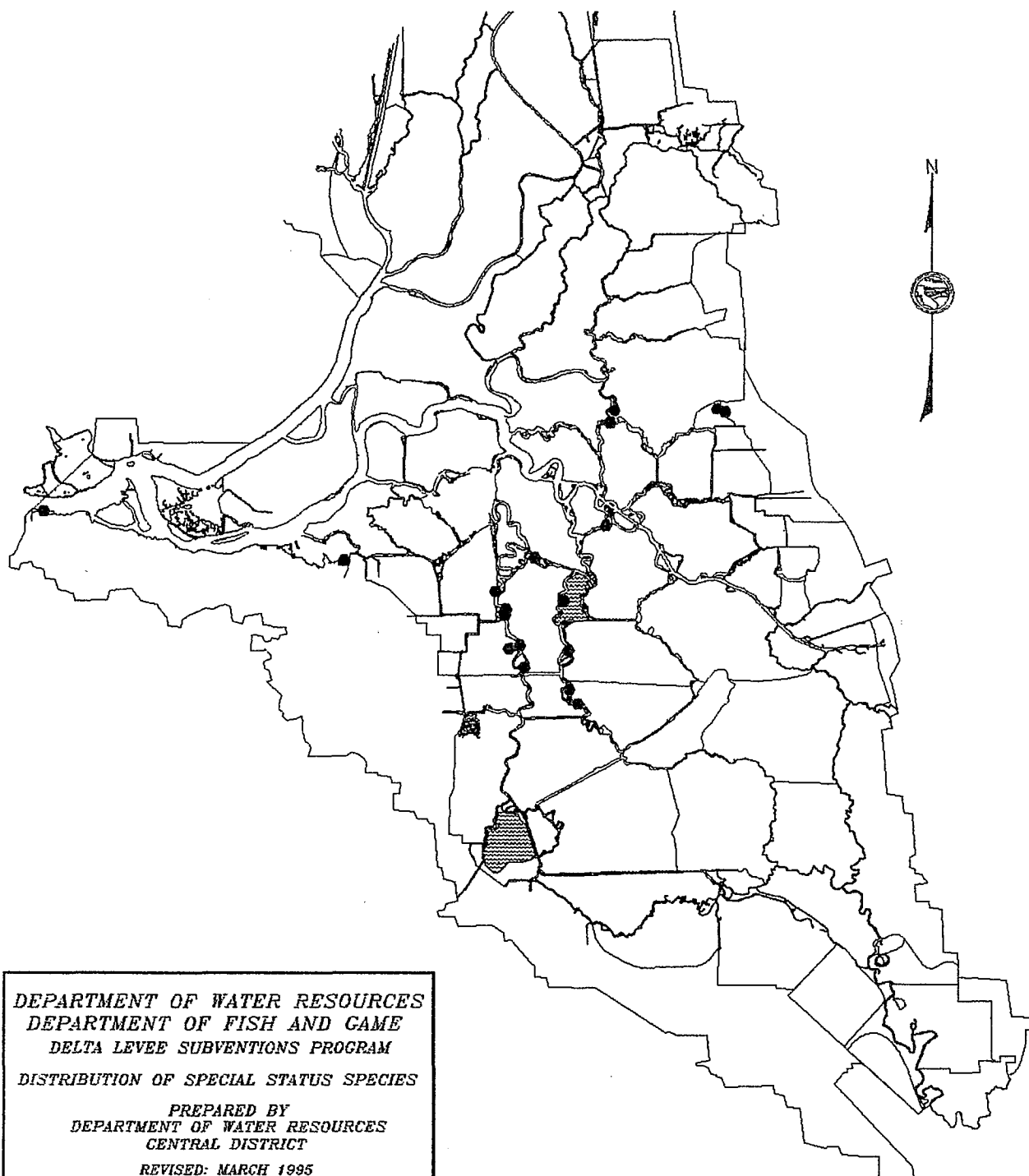
#### **Project Impact:**

Suitable marsh habitat bordering much of the levees in the Delta is completely lacking or is limited to a narrow strip 10 to 15 feet wide or less. Levee work along these areas would, in general, not result any direct losses of suitable rail habitat. However, it is important that projects not disturb or remove vegetation along levees such as Trapper Slough bordering Highway 4 (between Whiskey Slough and Middle River) where suitable stands of vegetation grow along the existing levees and into the channel.

Significant impacts to black rails may also occur if projects result in any disturbance to channel islands. Such disturbances may include dredging of nearby channels which result in accelerated rates of erosion, or the development of mitigation projects which alter vegetative cover or composition to less suitable conditions.

# SACRAMENTO-SAN JOAQUIN DELTA

◆ CALIFORNIA BLACK RAIL SITES



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## MAMMALS

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Salt-marsh harvest mouse - DFG photo by Dave Schaub

**Salt-marsh Harvest Mouse**  
(*Reithrodontomys raviventris*)

**Status:**

The salt-marsh harvest mouse is listed as an Endangered species by the USFWS and CDFG.

**Description:**

This timid little mouse, which is rarely seen except during winter flood tides, is about the size of a regular house mouse. Its fur is deep brown, with underparts of buffy-white to cinnamon. They can be distinguished from the western harvest mouse (*Reithrodontomys megalotis*) by a darker coloration on the back. The salt-marsh harvest mouse is also both geographically and genetically isolated from the western harvest mouse.

Although listed as a single Endangered species, the salt-marsh harvest mouse is actually two separate subspecies. The northern subspecies (*R. r. halicoetes*) inhabits wetlands bordering San Pablo and Suisun bays, while the southern subspecies (*R. r. raviventris*) occurs in Central and South San Francisco Bay (USFWS, 1984).

**Distribution:**

While harvest mice are not uncommon in California, the salt marsh-harvest mouse is found only in the emergent wetlands of San Francisco Bay and its tributaries. The northern subspecies, *R. r. halicoetes*, occurs on Marin Peninsula, through Petaluma, Napa, and Suisun marshes, and in northern Contra Costa County. The southern subspecies, *R. r. raviventris*, is mostly restricted to a band extending from San Mateo and Alameda counties south along both sides of San Francisco Bay to Santa Clara County, with isolated populations also occurring in Marin and Contra Costa counties.

**Habitat:**

The salt-marsh harvest mouse inhabits both tidal and non-tidal marshlands around Suisun, San Pablo, and San Francisco bays. Its principal habitat is composed of moderate-to-dense vegetative cover with an escape habitat of adjacent grasslands during extremely high winter tides (Fisler, 1965). Optimal habitat consists of 100 percent vegetative cover dominated by pickleweed (*Salicornia* spp.), cordgrass (*Spartina* spp.), salt grass (*Distichlis spicata*), or fat hen (*Atriplex* spp.) (Shellhammer et al., 1982). This cover appears to be a major factor affecting utilization (Fisler, 1965). The mice move into the higher ground of marshes during high water outflows and high tides, but are restricted to the marshes because of their behavioral dependence on extensive cover. In fact, they are so dependent upon cover that open areas or roads 30 feet wide can provide barriers to movement (USFWS, 1984).

Specific data on food habits are largely unknown, but the mice are believed to feed primarily on green vegetation, usually pickleweed and salt grass (Fisler, 1965). Insects and other invertebrates may also be consumed. Freshwater is required, but both subspecies are also capable of drinking saltwater (Fisler, 1965; Zetterquist, 1977).

#### **Life History:**

*R. r. halicoetes* builds nests of grasses and sedges on the ground and breeds from May to November. *R. r. raviventris* does very little nest building, but may construct loosely organized structures of dry grasses. Breeding by this subspecies occurs mainly from March to November. *R. r. raviventris* may produce up to two litters each year, while the shorter breeding season of *R. r. halicoetes* suggests that this form has one litter per year (Fisler, 1965). Litter sizes average about four young for both subspecies. Very little is known about weaning or sexual maturity.

#### **Endangerment:**

Salt-marsh harvest mice have largely decreased in numbers due to habitat destruction from commercial and residential development around the San Francisco Bay area. Filling and diking of tidal marshlands has greatly also reduced the availability of high marsh and transition habitat the mice use during high winter tides (Shellhammer, 1977). Despite the protection which the Endangered status gives the mouse, it is still being threatened by further development of wetland areas, flood control projects, mosquito abatement activities, and freshwater encroachment caused by increased sewage plant discharges.

#### **Project Occurrence:**

The subspecies under consideration here, *R. r. halicoetes*, usually inhabits the salt and brackish marshes from approximately San Pedro in Marin County, along the northern shore of San Pablo Bay, and along both shores of Suisun Bay to about Collinsville in Solano County. While the northern subspecies' range lies within the western edge of the study area, it has yet to be documented along levees considered for flood protection work as part of this project. It has, however, been recorded on the interior of some western islands.

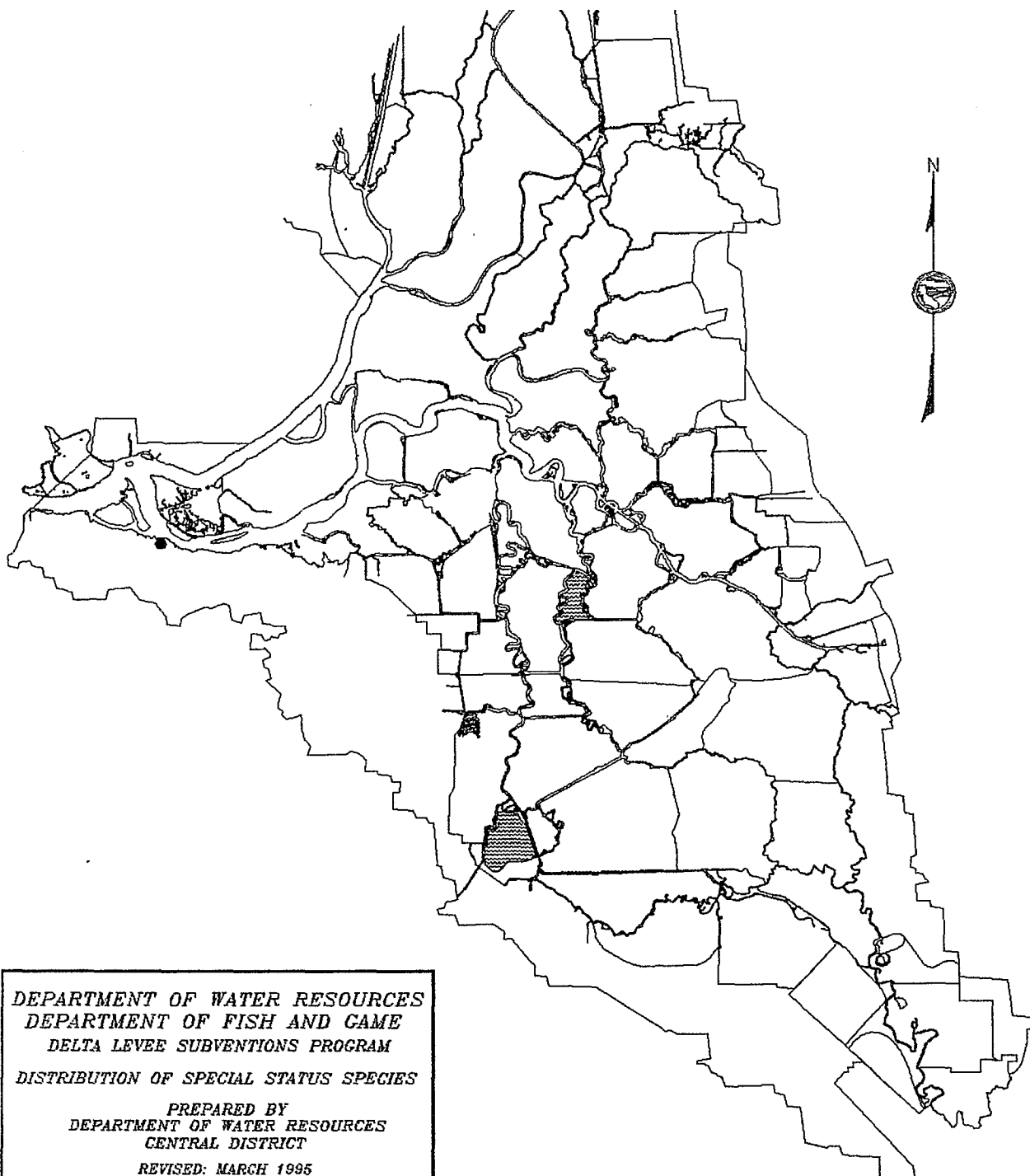
#### **Project Impact:**

The potential for impacts to this species varies, and the factors involved are quite complex. For the most part, it does not occur within the project area. However, projects involving the interior of islands in the western Delta (e.g., Van Sickle, Winter, or Sherman islands) could result in the alteration of potentially usable habitat and the overall reduction of the species' potential range. This could occur when the toe of the levee is expanded inland or the interior marshes are used as dredge spoil sites.



# *SACRAMENTO-SAN JOAQUIN DELTA*

● *SALT-MARSH HARVEST MOUSE SITES*



**San Joaquin Kit Fox**  
(*Vulpes macrotis mutica*)

**Status:**

The San Joaquin kit fox is classified as an Endangered species by the USFWS and a Threatened species by the CDFG.

**Description:**

The kit fox (*Vulpes macrotis*) is the smallest fox in North America. The San Joaquin kit fox is the largest of the kit fox subspecies, averaging 20 inches in body length and 9 to 12 inches in height at the shoulder. These slender-built foxes are characterized with relatively long legs and large, conspicuous ears. Its fur is tan to buffy-gray in summer and silver-gray in winter. Ventral coloration is white year-round. The sides of its muzzle in front of the eyes are blackish, and the tip of the tail is black.

**Distribution:**

The San Joaquin kit fox historically occurred throughout most of the San Joaquin Valley from the vicinity of Tracy to southern Kern County. Today, the kit fox occupies the arid, undeveloped lands along the valley floor and foothills from the Tehachapi Mountains around the south end of the San Joaquin Valley, north along the western foothills of the valley to Byron in Contra Costa County, and north along the eastern edge of the valley to Visalia in Tulare County (DFG, 1992a). Portions of Monterey, Santa Clara, San Benito, and Santa Barbara counties are also included in the kit fox's range (DFG, 1992).

**Habitat:**

Kit fox typically live in sparsely vegetated arid areas which are dominated by scattered brush. The habitat requirements of the kit fox consists primarily of suitable denning opportunities and an adequate prey base.

Dens are usually excavated on flat or gently sloping, loose-textured soils. They appear to prefer the western side of the valley where the soil is softer, presumably because of the kit fox's inability to dig in shallow or hard substrates (Morrell, 1972). It is believed that the kit fox will often modify and use dens constructed by other animals (Morrell, 1972). The dens may consist of one to several entrances and average 8 to 10 inches in diameter (Egoscue, 1962).

Kit fox are mainly nocturnal with most activity taking place throughout the night (Grinnell et al., 1937; Morrell, 1972). They feed largely on small rodents, birds, reptiles, amphibians, and

large insects. They are thought to satisfy their water requirements from their prey and do not need sources of drinking water (Morrell, 1972).

#### **Life History:**

Kit fox adults are usually solitary during the non-breeding season, June through October, and occupy small, individual dens (Morrell, 1972). Females begin cleaning and enlarging the dens during September and October and are joined by the males in October and November (Morrell, 1972). Breeding occurs from December through January or February and the pups are born in February or March (Morrell, 1972). During this period, kit fox will use a large number of dens, typically four or five. The pups will emerge from the dens at about the age of one month and will remain with the family until the age of four or five months (Morrell, 1972). The young become sexually mature in their second year. Some pairs remain essentially monogamous, and may mate for life, while others change partners frequently.

#### **Endangerment:**

Loss of suitable habitat appears to be the limiting factor for the San Joaquin kit fox. More acres are being put to agricultural, industrial, and urban development every year, decreasing the amount of habitat available for the kit fox (Laughrin, 1970). The effects of pest control programs on this species may also be having a significant impact, either through secondary poisoning and/or depletion of prey species.

#### **Project Occurrence:**

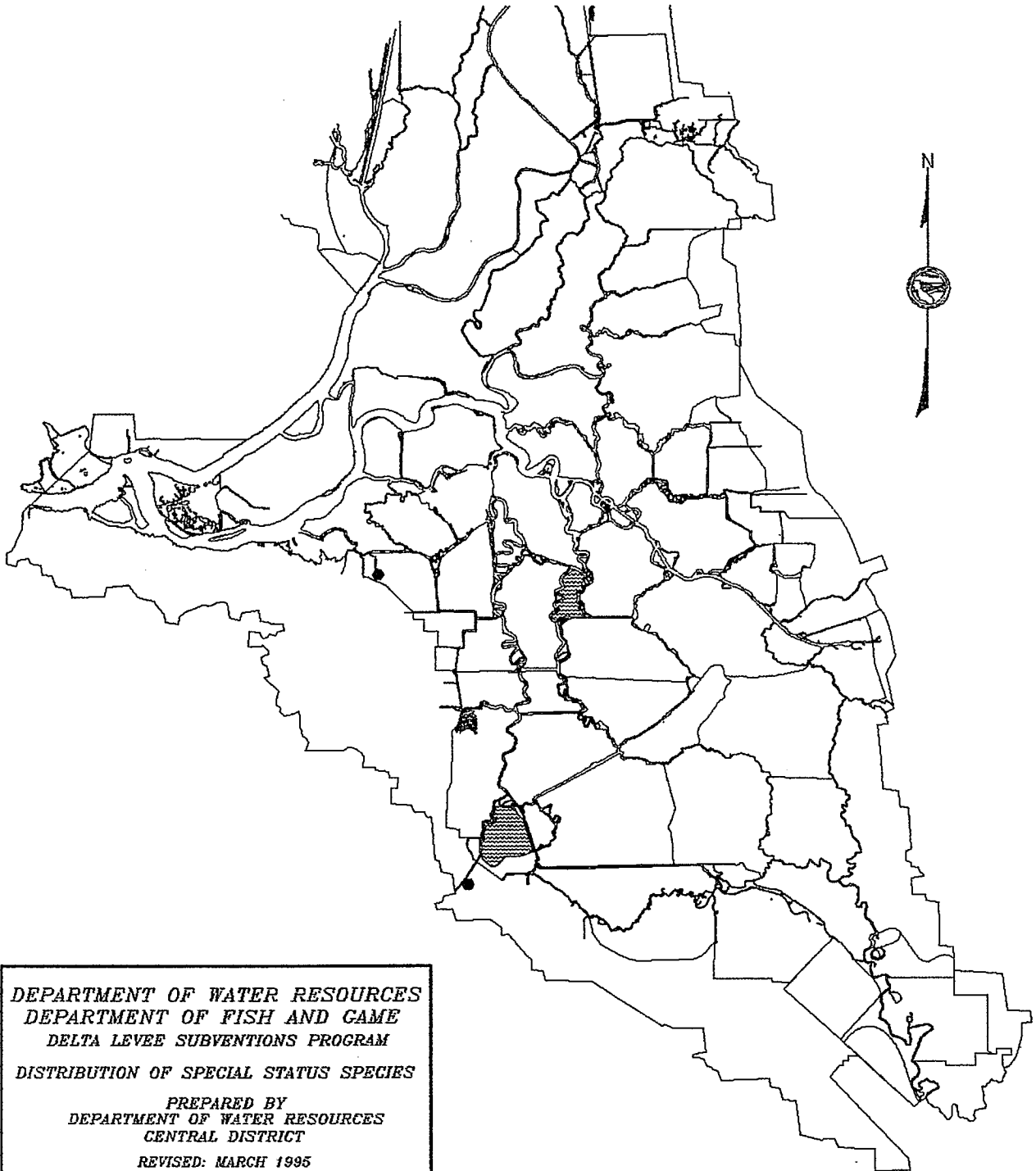
The Sacramento-San Joaquin Delta lies on the northern periphery of the kit fox's range. In this region, the kit fox is limited to the southeastern portion of Contra Costa County (east slope of Mount Diablo), and is considered rare in the study area. Any potential expansion of its identified range into the islands or tracts of the Delta would be severely restricted by the large acreage of intensively developed agricultural lands in the Delta and upper San Joaquin Valley.

#### **Project Impact:**

No impacts to this species are expected as a result of SB 34 projects. While the kit fox may occasionally be found outside of its identified range, intensively developed agricultural lands in the Delta do not provide habitat conditions suitable for the establishment of any long-term breeding or resident populations.

# *SACRAMENTO-SAN JOAQUIN DELTA*

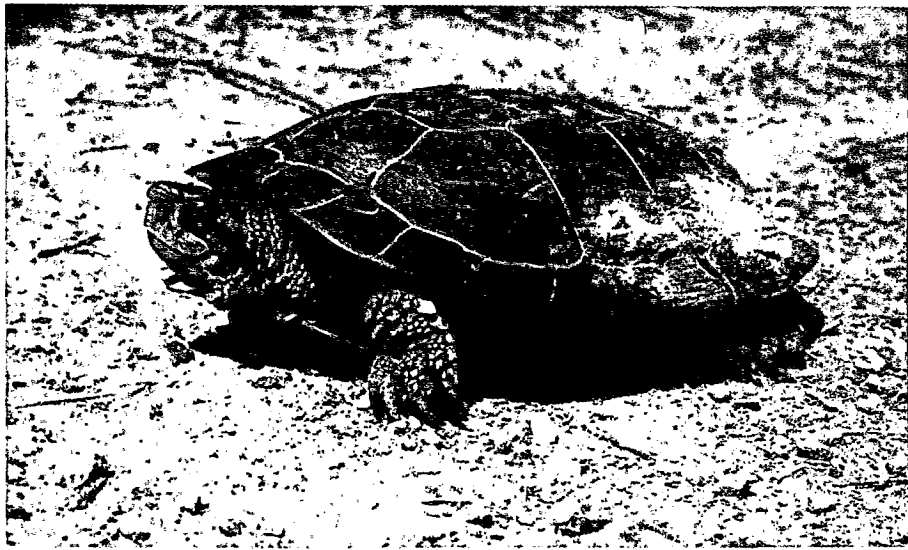
◆ *SAN JOAQUIN KIT FOX SITES*



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## REPTILES

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Western pond turtle - DFG photo by Ron Jurek

**Western Pond Turtle**  
(*Clemmys marmorata*)

**Status:**

The western pond turtle is designated as a Category 2 Candidate species by the USFWS.

**Description:**

The western pond turtle is a moderate-sized, drab brown turtle lacking prominent markings on its shell. At close range, its shell can frequently be observed to have a network of spots, lines, or dashes of brown or black that radiate from the center of each shield. Hatchlings are approximately an inch long and adults grow to about 8 inches. Males are distinguished from females by their larger head, shorter and thicker tails, and flatter, less heavily marked shells. Males are also considerably lighter than females.

Based on the analysis of Seeliger (1945), the western pond turtle has been divided into two subspecies: the northwestern pond turtle (*C. m. marmorata*) and the southwestern pond turtle (*C. m. pallida*). General morphological trends are that the northwestern pond turtle is larger in size and darker in color than the southwestern pond turtle. The two subspecies intergrade over a large area in central California.

**Distribution:**

Currently, two subspecies of the western pond turtle are recognized. The northwestern pond turtle, *C.m. marmorata*, occurs from the vicinity of the American River in California northward to the Puget Sound/Seattle area in Washington. The southwestern pond turtle, *C. m. pallida*, occurs from the vicinity of Monterey in California south to northwestern Baja California Norte. Central California populations are described as representing an intergradation of the two subspecies (Seeliger, 1945).

**Habitat:**

The western pond turtle occurs in a variety of aquatic environments, including brackish water habitats. Its optimal habitat appears to be warm, permanent ponds or slough systems with abundant cover and basking sites. They are uncommon or absent in heavily shaded areas, large lakes, human-made or modified waterways such as canals, and the faster moving stretches of rivers and streams.

Basking sites typically include partially submerged logs, rocks, mud or sand banks, cattail mats, and other debris. They may also engage in "aquatic" basking, utilizing the aquatic environment to engage in thermoregulatory behavior (Holland, 1985).

Prior to nesting, females generally leave the watercourse and move some distances overland to nest. The distances between the watercourses and nest locations have ranged from at least 50 feet to over 1200 feet, with distances of over 450 feet being common (Storer, 1930; Holland, unpubl. data.). Along the courses of slow-moving rivers and sloughs, eggs are generally deposited in sandy areas near the bank. Along foothill streams, females may climb hillsides, sometimes moving considerable distances to find a suitable nest site. Hibernation takes place in adjacent upland habitats, with some individuals having been found overwintering several hundred yards from the watercourse.

The diet of the western pond turtle is mostly comprised of aquatic invertebrates, but also includes fish larvae, carrion, and plant material. Foraging usually takes place during the daytime, although some may be active throughout the night in summer.

#### **Life History:**

Breeding has been observed in the field in June and August and in captivity in August and September. Females probably lay eggs biennially, although some may oviposit every year. The incubation period in captivity is seventy to eighty days (Feldman, 1982), and the few records from natural nests were incubated for ninety-five to one hundred-six days (Holland, 1985; 1991). Most hatchlings probably overwinter in the nest (Holland, 1985; 1991) and emerge from the nest and move to the watercourse in early spring, usually March or April. Sexual maturity varies, but typically is attained in about eight years (Holland, 1991).

Seasonal activities vary considerably. The western pond turtle is generally active throughout the year in the southern and central coast range of California; however, in parts of the Central Valley and areas north, activity typically begins in March and peaks in June or July, decreases gradually in August, increases briefly in September, and usually terminates by November (Holland, 1989).

#### **Endangerment:**

The commercial harvest of western pond turtles for food played a significant role in the initial decline of populations. Additional losses occurred as a result of dams and the creation of reservoirs along many water courses. Ongoing losses of suitable habitat from extensive water diversion efforts for agricultural and other purposes will continue to threaten even more populations.

#### **Project Occurrence:**

Western pond turtles (adults) have been recorded in waterways throughout the Sacramento-San Joaquin Delta. Adults are most often seen during the spring and summer months. Overwintering probably occurs along levees or on the interior of islands. Small turtles have never been recorded in the western or central regions of the Delta, and, therefore, it is unknown whether any viable breeding populations exists in the region.

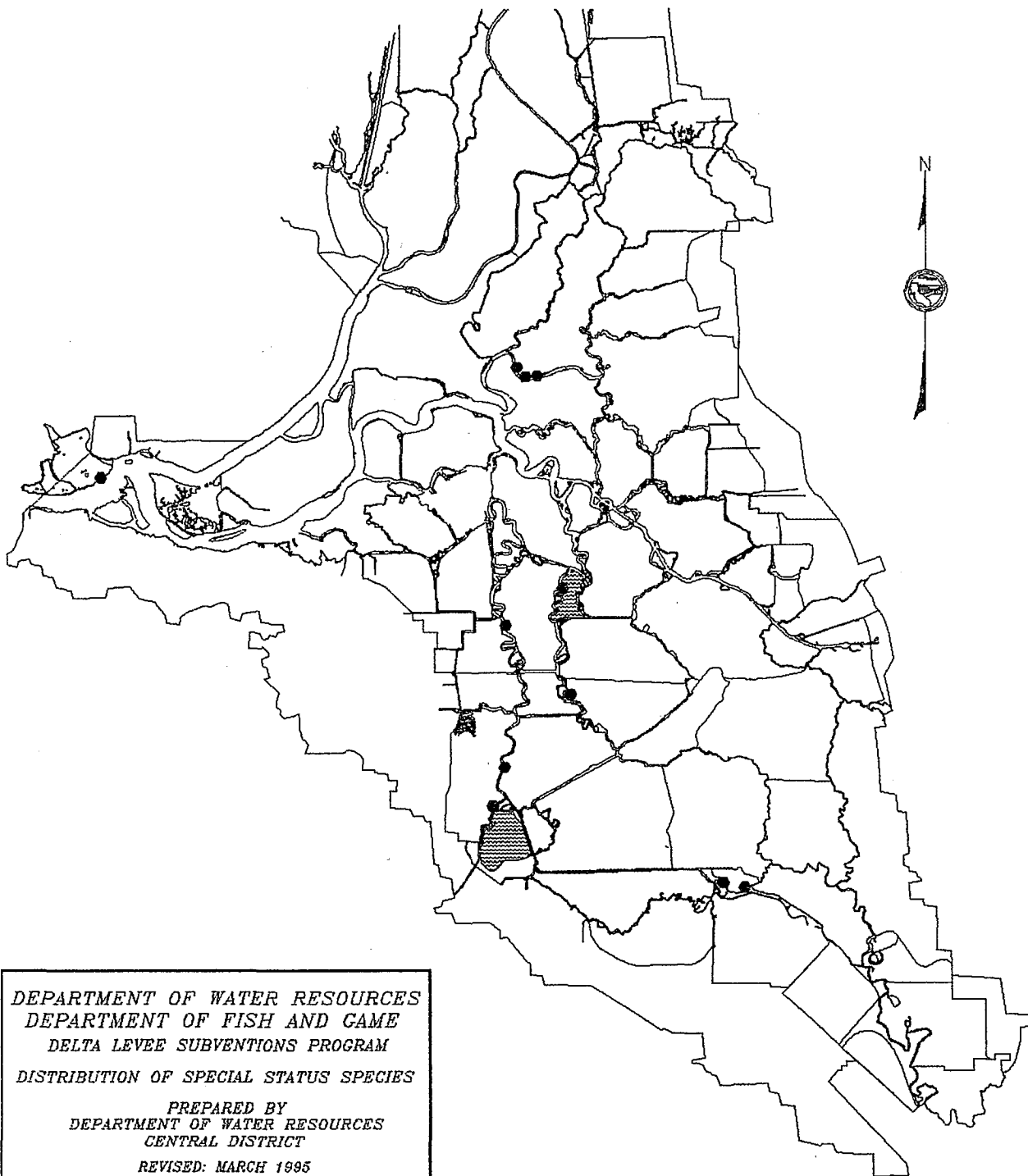
**Project Impact:**

Impacts to the western pond turtle due to levee projects are difficult to determine without additional information regarding the species' nesting and overwintering habitats within the Delta. Potential impacts include the short-term effect of discouraging any reestablishment of vegetation which the turtles may inhabit and the long-term effect of reducing habitat suitability throughout the Delta. The alteration or removal of various debris, such as partially submerged logs or rocks, could also result in the loss of potential basking habitats. Overwintering habitats may be affected by projects which involve the landside of the levee or levee crown where the turtles may hibernate.



# *SACRAMENTO-SAN JOAQUIN DELTA*

● *WESTERN POND TURTLE SITES*



**Giant Garter Snake**  
**(*Thamnophis gigas*)**

**Status:**

The giant garter snake is classified as a Threatened species by both the USFWS and CDFG.

**Description:**

The giant garter snake is perhaps the largest and most aquatic garter snake in California. Females may grow to lengths of up to 5 feet. The basic color is dull brown with a checkered pattern of well separated black spots on the dorsal side. There is also a pale yellow dorsal stripe and a pair of light colored (often reduced) lateral stripes. Sometimes the stripes are so faded that the snake appears uniformly dull brown.

**Distribution:**

Fitch (1940) described the original range of the giant garter snake from the vicinity of Sacramento and Antioch southward to Buena Vista Lake near Bakersfield. Its present range extends from the vicinity of Burrell in Fresno County north through the Central Valley to the Greatly area in Butte County. The largest remaining habitat of the giant garter snake remains in the American River Basin in Sacramento County (Brode and Hansen, 1992).

**Habitat:**

Giant garter snakes are highly aquatic snakes which rely upon the aquatic environment for food and protection. They are typically found in shallow, slow-moving waterways which are slightly turbid. The snakes seem to prefer sloughs and canals with grassy banks and heavy tule growth. They can also be found in temporary waters such as irrigation ditches and flooded rice fields (Hansen, 1988). High ground or uplands which provide refuge from flood waters is also important in winter. Large bodies of water where predatory fish are present, or areas with lightly vegetated banks or riprapped banks, are usually avoided, as well as riparian zones with dense growths of cottonwoods and shrubs.

Basking areas are also an important component in the habitat of the giant garter snake. These areas must receive adequate sunlight and at the same time screening vegetation to prevent prolonged exposure to the view of predators. Basking sites are nearly always located directly adjacent to escape cover such as water or vegetation (Hansen, 1988).

The cool winter months are spent in dormancy, probably in cracks, mammal burrows, and under rocks or other structures. Close proximity to overwintering sites is probably preferred, although they have been known to move over 200 yards from the shoreline of their summer habitat (Hansen, 1988).

The giant garter snake is an aquatic feeder which specializes in ambushing small fish. Although the snake may consume the larvae and young of amphibians, the presence of small fish may enable them to compete successfully with the more common and terrestrial valley garter snake (*Thamnophis sirtalis*) (Hansen, 1988).

#### **Life History:**

Giant garter snakes are generally active from April through September with some activity occurring in March and October. Fitch (1940) reported that the snake was active only during the day; however, recent observations have shown the snake foraging at night during the hot summer months (Hansen, 1980). They hibernate in adjacent upland habitats in fall and winter, often using old ground squirrel burrows as hibernation dens.

Little is known about the snake's reproductive cycle, although the snake is known to breed during the spring and bear live young with an average litter size of 23, range 10 to 46 (Hansen, 1980).

#### **Endangerment:**

Urbanization (including housing, business, industrial, and recreational developments), agricultural development, and grazing of grassland communities has resulted in the destruction of wetlands and the channelization of streams, both essential habitats for the giant garter snake. Other threats to the species include pollution, introduction of large predatory fish, and pesticide use which has had an affect on its food chain.

#### **Project Occurrence:**

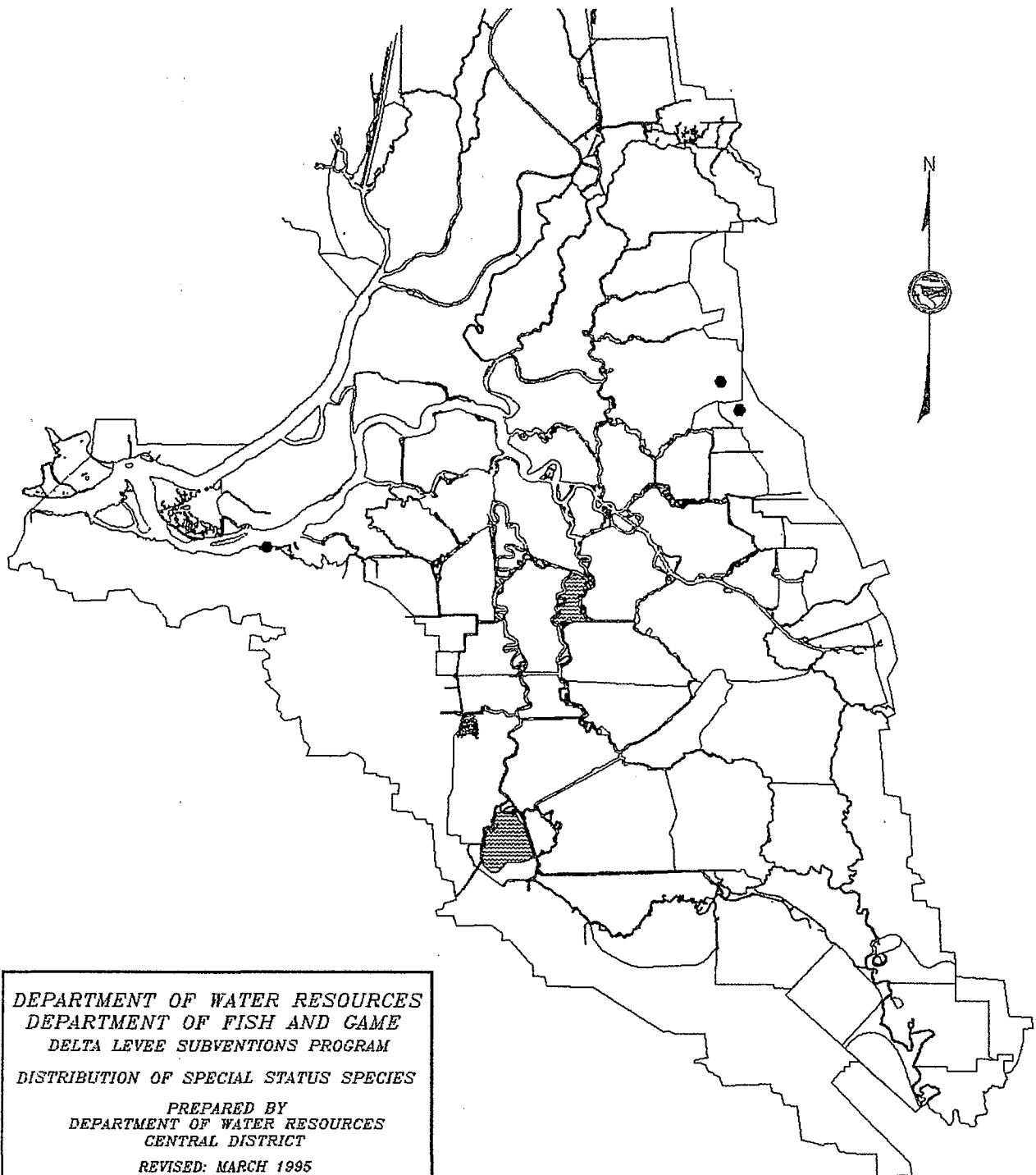
The giant garter snake is primarily restricted to the upper portions of sloughs and irrigation canals in the northern and eastern peripheries of the Delta. Although many other Delta waterways have been channelized and their banks rip-rapped, suitable habitat for the snake may still exists in marshes, agricultural canals, and other aquatic environments on the interior of the islands.

#### **Project Impact:**

Although the giant garter snake has been known to occur along the eastern periphery of the Delta, suitable habitat for the snake is not generally found along the steep banks of existing levees in the project area. Instead, habitat for the snake occurs primarily in marshes and irrigation ditches on the interior of the islands or tracts. It is important that these areas not be adversely affected by the development of SB 34 mitigation projects.

# SACRAMENTO-SAN JOAQUIN DELTA

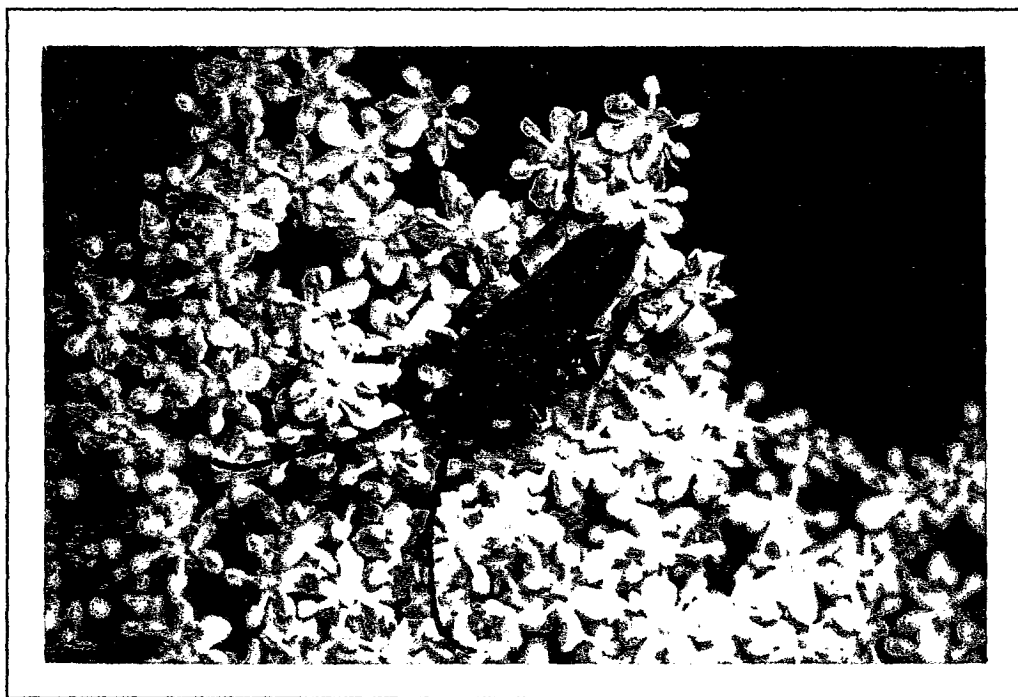
● GIANT GARTER SNAKES SITES



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## INSECTS

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Valley elderberry longhorn beetle - Photo by Richard Arnold

**Antioch Dunes Anthicid Beetle and Sacramento Anthicid Beetle**  
(*Anthicus antiochensis* and *Anthicus sacramento*)

**Status:**

Both the Antioch Dunes anthicid beetle and Sacramento anthicid beetle are classified as Category 2 Candidate species by the USFWS.

**Description:**

Anthicid beetles are relatively small, flightless, ant-like beetles restricted to sand dunes along river banks. In North America, there are approximately 57 species which belong to the genus *Anthicus*, of which about 21 occur in California. *Anthicus antiochensis* and *Anthicus sacramento*, commonly referred to as the Antioch Dunes anthicid beetle and Sacramento anthicid beetle, respectively, are two species known to occur in the Sacramento-San Joaquin Delta, and both are candidates for listing by the USFWS.

The beetles are very similar to each other and other *Anthicus* species. The Antioch Dunes anthicid beetle was described by Werner (1975) from specimens collected in 1953 from the Antioch Dunes near Antioch. The Sacramento anthicid beetle was described by Chandler (1978) from specimens collected from the dune areas at Grand Island and Rio Vista. The Antioch Dune anthicid beetle is generally easier to identify because of its larger physical size (approximately 0.18 to 0.21 inches); it is the largest *Anthicus* species in North America. The Sacramento anthicid beetle, because of its smaller size (about 0.12 to 0.14 inches) and similarity to other *Anthicus* species, requires closer examination.

**Distribution:**

The original habitat of the Antioch Dunes and Sacramento anthicid beetles is thought to be the sand dune areas at Antioch in Contra Costa County. Stabilization of the Antioch Dunes during the 1950's is believed to have eliminated any populations that may have occurred there. The beetles' current range includes the riverine sand dunes from the lower portions of the Sacramento and San Joaquin rivers north to Shasta County (Davis, 1991).

**Habitat:**

Both beetles are restricted to the unstable environment of sand dunes along river banks. They prefer habitats composed of loose sand and vegetation. Loose sand deposited by either wind, water, or man is considered to be an essential habitat requirement for the beetles (Hagen, 1986). The need for this loose sand may be related to their surface feeding strategy and the ability of loose sand to act as a refuge from predators such as ants (Hagen, 1986). Although the importance of vegetation as a habitat component is not completely understood, Davis (1991) observed the Antioch Dunes anthicid beetle in both unvegetated and partially vegetated

habitats. On the other hand, the Sacramento anthicid beetle was found almost exclusively in partially vegetated habitats (Davis, 1991). Vegetation consisted mostly of giant reed (*Arundo donax*) and willows (*Salix* spp.).

The beetles are generally active at night, foraging on the surface of the sand. During the day, they are inactive, spending most of their time burrowed in the sand. Members of the genus *Anthicus* are generally detritus feeders. Adults readily feed on organic debris, including dead insects. The larvae of most species consume leaf litter and/or soil fungi.

#### **Life History:**

Little information is known about the larval development and life span of these beetles. Davis (1991) observed mating to occur from mid-March to mid-April followed by the appearance of larvae in mid-April through May. Adults have been collected primarily from May through August with peak abundance occurring in June and July. Attempts to collect these beetles at other times of the year have not been very successful, particularly from November through February when the beetles appeared to be inactive (Hagen, pers. comm.; Davis, 1991). Both species are assumed to reproduce once a year, as larvae have only been collected during the April and May time period (Hagen, pers. comm.).

#### **Endangerment:**

So little is known about the species that it is difficult to determine if the beetles actually warrant any official listing, or are merely rare and inconspicuous with populations in other areas which have not been surveyed yet. Channelization of rivers and sloughs within the Delta has eliminated much of the beetles natural, sandy habitats; however, dredge material disposal sites, although artificially created, are considered excellent replacement habitats (Hagen, pers. comm.; Davis, 1991).

#### **Project Occurrence:**

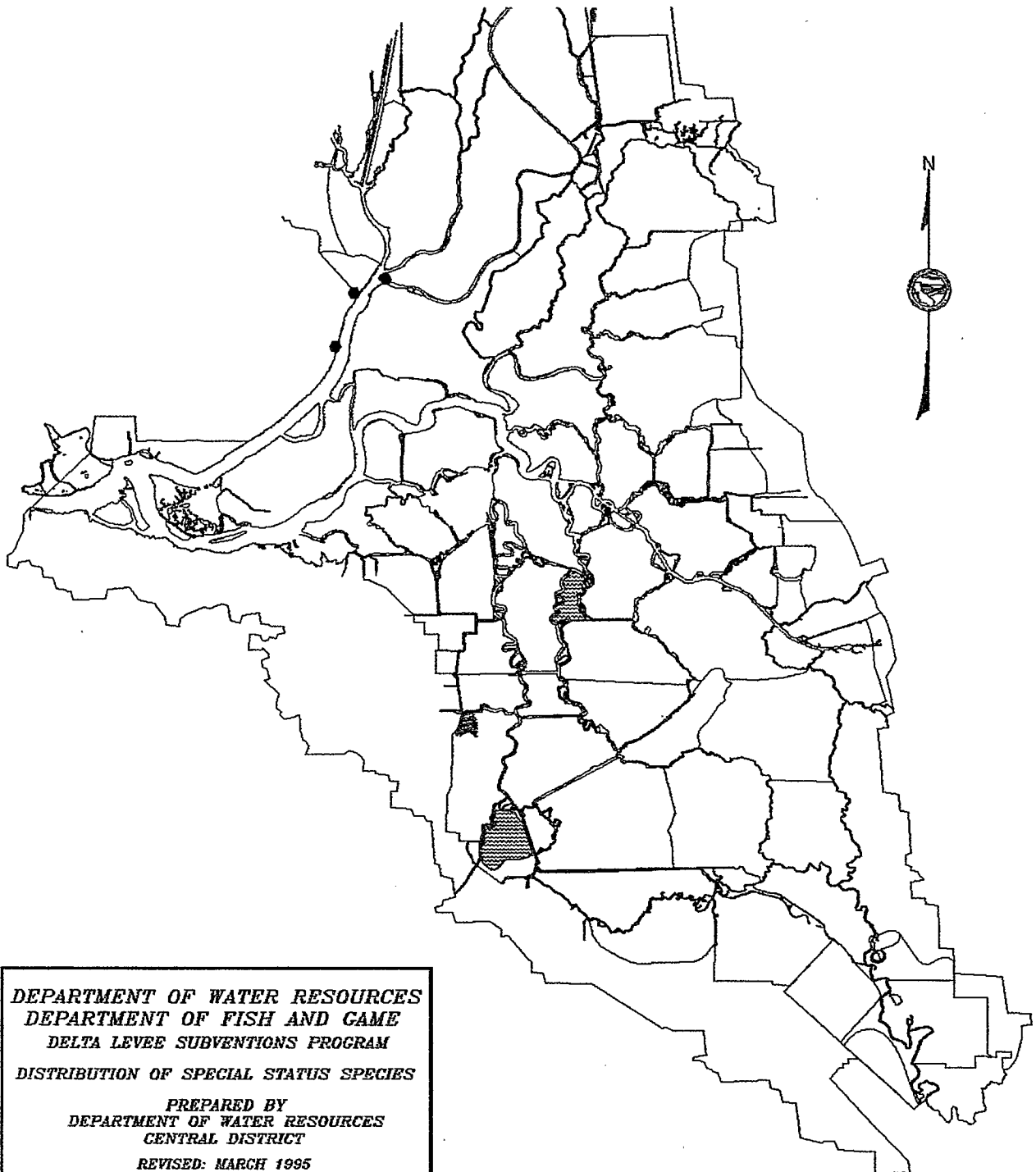
The Antioch Dunes anthicid beetle is currently known from the following three areas within the Sacramento-San Joaquin Delta: sand dune area south of Rio Vista, southwestern tip of Grand Island, and sand dune area north of Rio Vista (Hagen, 1986; Davis, 1991). The Sacramento anthicid beetle is also known from these three areas, and at an additional site near the northwestern end of Brannan Island (Hagen, 1986; Davis, 1991). Neither species, however, is currently known from SB 34 work areas.

#### **Project Impact:**

It is unlikely that SB 34 levee projects would result in any significant adverse impacts to the beetles. None of the known colonies are found on areas subject to potential SB levee maintenance, and, although the beetles may be found in other areas of the Delta, potential habitat is not suspected of occurring along SB 34 work areas.

# *SACRAMENTO-SAN JOAQUIN DELTA*

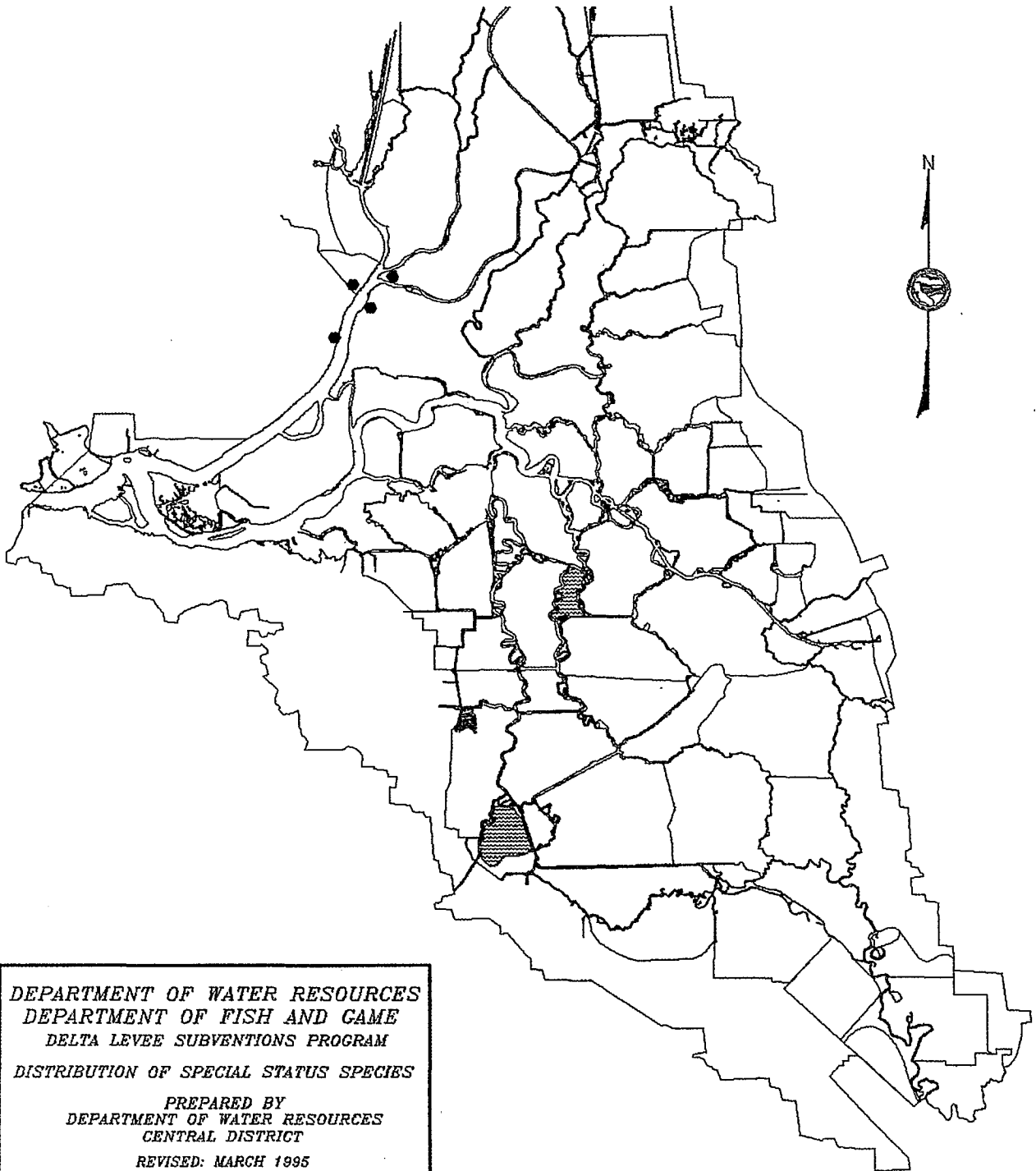
● *ANTIOCH DUNES ANTHICID BEETLE SITES*





# *SACRAMENTO—SAN JOAQUIN DELTA*

● *SACRAMENTO ANTHICID BEETLE SITES*



**Valley Elderberry Longhorn Beetle**  
(*Desmocerus californicus dimorphus*)

**Status:**

The valley elderberry longhorn beetle is listed as a Threatened species by the USFWS.

**Description:**

The valley elderberry longhorn beetle (VELB) is an insect specific to the elderberry (*Sambucus* sp.), a common riparian plant in the Central Valley of California. The VELB is cylindrical in shape and almost an inch long. Males of this subspecies may exhibit one of two different color patterns. In some, the elytra resemble those of the coastal subspecies (*D. c. californicus*), whose back is a dark metallic green with a red or reddish orange border (USFWS, 1984). In other males, the metallic green pattern on the elytra is just four oblong spots. Females are larger than males and resemble *D. c. californicus*.

All *Desmocerus* utilize various species of elderberry as food plants. The presence of the VELB is often determined by exit holes which adults create on the bark of elderberry plants after completing pupation. These exit holes are round or slightly oval in shape and about ¼ inch in diameter.

**Distribution:**

Two subspecies of elderberry longhorn beetles occur in California. The California elderberry longhorn beetle (*D. c. californicus*) is found primarily along the coastal ranges from Mendocino County southeast to Los Angeles and Riverside counties (Linsley and Chemsak, 1972), with a few isolated records from Trinity, San Diego, and eastern San Bernardino counties (Halstead, 1990). The valley elderberry longhorn beetle (*D. c. dimorphus*) is native to moist valley oak woodlands near running water throughout the lower Sacramento and upper San Joaquin valleys.

Based on adult specimens, the known range of the valley elderberry longhorn beetle extends from Red Bluff in Tehama County south to the Kaweah River in Tulare County (USFWS, 1991). Exit hole records have further expanded its range as far north to Redding in Shasta County and as far south to Bakersfield in Kern County (USFWS, 1991).

**Habitat:**

The VELB inhabits the banks of rivers and streams and adjacent grasslands in riparian areas where elderberries grow. The elderberry occurs in several types of environments, particularly in riparian areas along rivers and streams.

Because of problems with the taxonomy of *Sambucus* species resulting from genetic differences, possible hybridization, and the need for a generic revision, the species serving as host(s) for the VELB has/have been in question (USFWS, 1991). Limited data indicate that the VELB uses various species, and none are preferred over the other. Elderberries are the only host plant known to have the potential to support the VELB, and the VELB inhabits elderberries of various sizes, ages, and growth forms, and utilizes an assortment of branch sizes for larval development. VELB emergence holes have been observed in shoots or branches with diameters as small as ½ inch to as large as 8 inches, most often between 3 and 4 inches (Halstead, 1991; Jones and Stokes, 1987). The distribution of the heights of VELB exit holes above the ground varies from near ground to 9 feet, most often 3 to 4 feet (Jones and Stokes, 1987; USFWS, 1991). The beetles appear to be found in clusters which are not evenly distributed across available elderberries (USFWS, 1991).

Specific preferences of the VELB are unknown. The larvae bore into the pith of live elderberry wood and the adults are assumed to feed on the foliage and perhaps flowers of elderberries (USFWS, 1984).

#### **Life History:**

The VELB spends the majority of its one- to two-year life span in larval development within the elderberry plant (Halstead, 1991). When the larvae are ready to pupate, they open an emergence hole through the bark and return to the pith for pupation (USFWS, 1984). After transforming into an adult, it chews an exit hole and emerges from the elderberry (USFWS, 1984). Adults may be present between March and June, but are most evident from late-April through mid-May. During this brief period in which they are adults, the female places eggs singly or in small groups in cracks and crevices near the base of elderberry shrubs (Halstead, 1991). Shortly after being laid, the eggs hatch and emerging larvae bore into the pith of larger stems (USFWS, 1984). The duration of each life stage is unknown, but the entire life cycle is assumed to encompass one to two years (Halstead, 1991).

Although many insects are known to burrow in wood for at least part of their life cycle, only the VELB is known to inhabit live elderberry wood and/or make exit holes of similar size and shape in the Central Valley (Nagano, 1989).

#### **Endangerment:**

The primary threats to the beetles appear to be the loss and alteration of habitat by agricultural conversion, grazing, levee construction, stream and river channelization, removal of riparian vegetation, shoreline rip-rapping, and urban, recreational, and industrial development. The use of insecticides and herbicides, particularly when adults are evident, may also be a factor limiting the beetle's distribution. Despite legal protection, host plants are still frequently injured through cutting and burning, and sometimes by herbicides.

**Project Occurrence:**

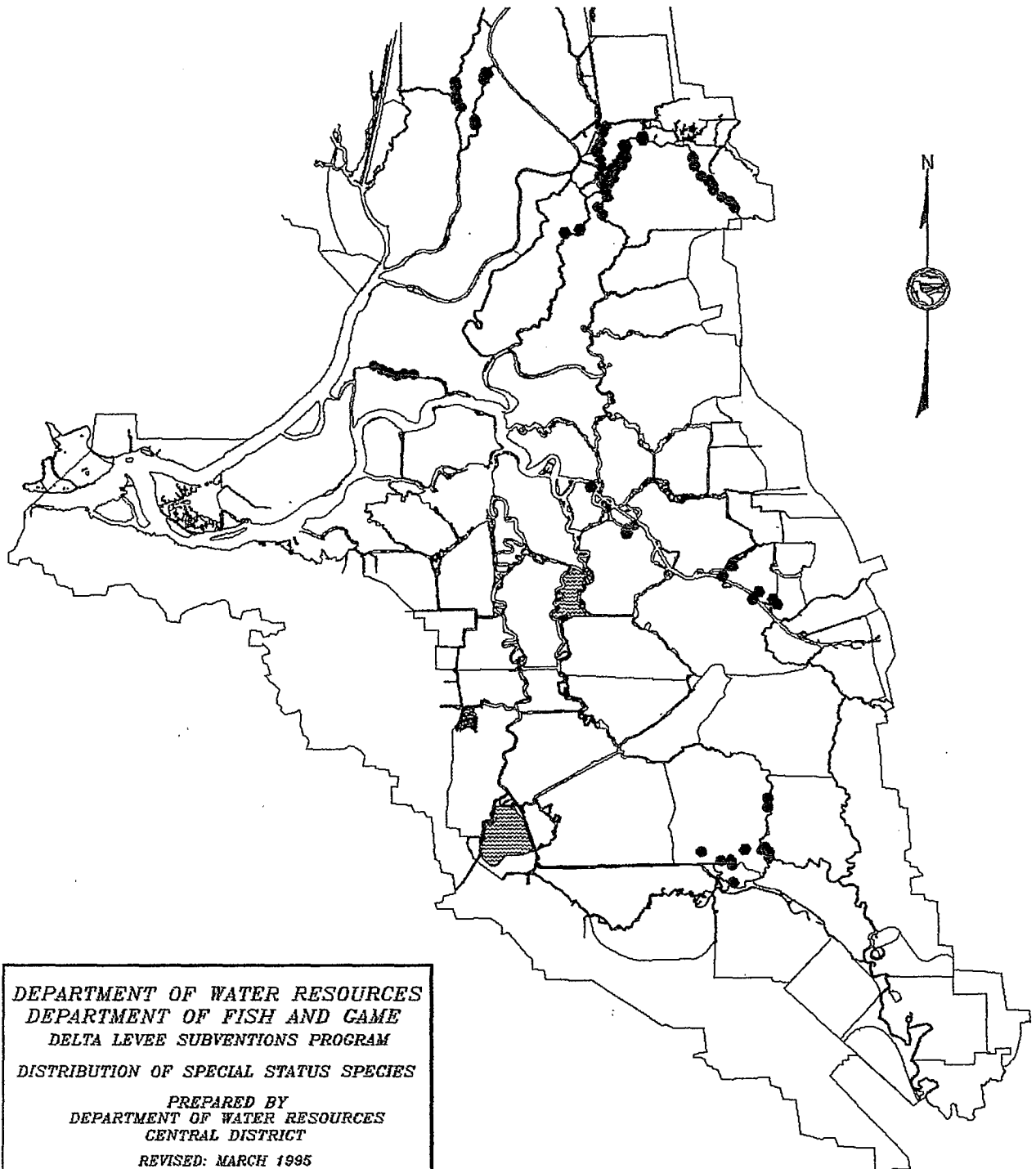
Elderberries can be found along the slopes or base of levees (both land- and waterside) throughout the Sacramento-San Joaquin Delta. Most reports of elderberries have been from the eastern regions the Delta. Actual VELB emergence holes have been documented at McCormack-Williamson and New Hope tracts.

**Project Impact:**

Elderberries occur in many areas within the Delta, and, for the most part, grow along the waterside of levee banks where they may be potentially affected by various levee projects. Any direct losses of elderberry plants would result in the immediate loss of VELB habitat, and possibly adult beetles or beetle larvae. Altering potential shoreline habitats to less suitable conditions, such as rip-rapping, may also have the cumulative impact of reducing the species' total available habitat, and, thus, limit the amount of potential future colonizing areas. In waterways such as Snodgrass Slough and the Mokelumne River, where actual VELB emergence holes have been documented, protection of the elderberries should be of primary importance.

## SACRAMENTO-SAN JOAQUIN DELTA

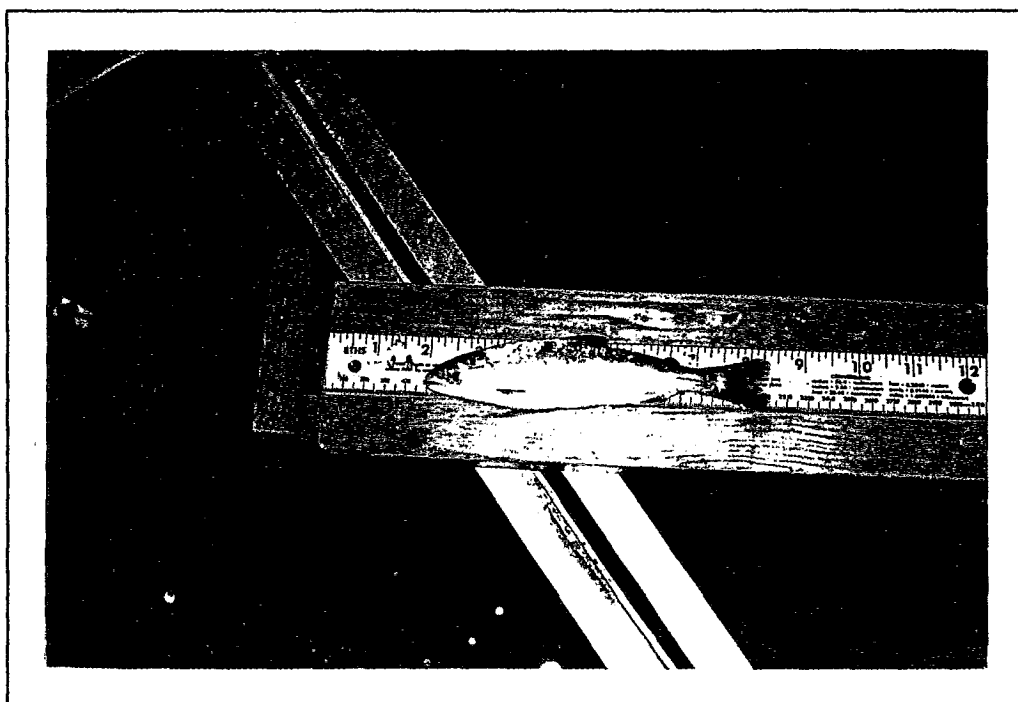
- ELDERBERRY BUSH SITES
- EVIDENCE OF VALLEY ELDERBERRY LONGHORN BEETLES



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## FISHES

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Juvenile chinook salmon - DFG photo by Barry Baba

**Delta Smelt**  
(*Hypomesus transpacificus*)

**Status:**

The Delta smelt is designated as a Threatened species by the USFWS and CDFG.

**Description:**

The Delta smelt is a small, slender fish that can grow up to 4 or 5 inches long, but generally reaches only 2 or 3 inches. It has a tiny mouth with small, pointed teeth which are present on both upper and lower jaws. Delta smelt are nearly translucent and have a silvery, steel-blue sheen to their sides.

**Distribution:**

The Delta smelt is only one of two native smelt species in the Sacramento-San Joaquin Estuary. Its current distribution extends from western Suisun Bay, depending on outflows, to as far upstream in the Sacramento River to the mouth of the American River. Spawning may occur from Roe Island in Suisun Bay to Garcia Bend in the Sacramento River (Wang, 1991).

**Habitat:**

The Delta smelt is an euryhaline species that spawns in freshwater and has been collected from estuarine waters up to 14 parts per thousand (ppt) salinity (Moyle et al., 1992). A large part of its annual life span is spent near the freshwater edge of the entrapment zone where the salinity is approximately 2 ppt (Moyle et al., 1992; DFG, 1992b; Sweetnam and Stevens, 1993).

Spawning takes place in shallow, fresh or slightly brackish water upstream of the entrapment zone. Most spawning occurs in tidally-influenced backwater sloughs and channel edgewaters (Moyle, 1976; Wang, 1991; Moyle et al., 1992; Sweetnam, pers. comm.). The eggs are believed to attach to various substrates such as rocks, gravel, tules, tree roots, and other submerged vegetation.

After hatching, the larvae float and drift with currents into the entrapment zone or to other areas of the estuary depending on flow conditions. In the entrapment zone, the mixing effect keeps the larvae from being swept into saltwater and also traps a large number of zooplankton, which is what the smelt feed on. Recently, this zone has been confined to small channel areas of the Delta due to low inflows and high water exports.

Delta smelt are opportunistic feeders on planktonic copepods, mostly the native *Eurytemora affinis*, and on the introduced *Pseudodiaptomus forbesi* in years when it occurs in high

abundance (DFG, 1992b). Also included in the diet are cladocerans, amphipods, and insect larvae. When the population moves downstream to Suisun bay, the opossum shrimp, *Neomysis*, becomes an important food source (Moyle, 1976). The fish schools in large numbers in the upper portions of the water column.

#### **Life History:**

Spawning occurs from late winter to early summer (January through July), with most spawning taking place in late April (Sweetnam, pers comm.). As smelt eggs descend through the water column, they attach to substrates (rocks, gravel, vegetation) near the bottom. The number of eggs laid by each female ranges from 1,247 to 2,590 (DFG, 1992b). Hatching occurs in about twelve to fourteen days (Sweetnam, pers. comm.). After hatching, larvae rise to the surface and are eventually carried by currents into the mixing zone where food is abundant and growth is rapid (Moyle and Herbold, 1989). Adult lengths are reached in about seven to nine months, and most smelt die after spawning in early spring. A few smelt may live to a second year, although it is uncertain whether these fish are able to spawn again.

#### **Endangerment:**

Smelt populations have shown considerable natural fluctuations, however, their numbers have been consistently low for the past decade. At one time, they were among the most abundant fish of the Sacramento-San Estuary, as indicated by their extreme abundance in Fish and Game trawl catches. Although populations have shown considerable annual fluctuations, they have now remained consistently low since about 1982. In fact, present numbers of Delta smelt appear to be at their lowest. Factors which are potential threats to the Delta smelt include the following: a decline in zooplankton abundance, a relatively low fecundity, entrainment in water diversions, low and high outflow years, dredging activities, hybridization (possibly), and competition and predation.

#### **Project Occurrence:**

It is likely that Delta smelt adults migrate to and through much of the study area on their spawning runs, and larval smelt pass downstream through the area after hatching. Potential spawning habitat exists in most watercourses, including the dead-end sloughs in the eastern edge of the Delta. The apparent center of spawning is around Bradford Island and in the Sacramento River just below Rio Vista (Wang, 1991). Currently, the nursery area for the smelt larvae extends from Jersey Island to Medford Island and is primarily concentrated in and around Frank's Tract (Wang, 1991).

#### **Project Impact:**

The use of riprap normally involves the removal of vegetation along streambanks. Removing streambank vegetation and preparing the banks for protective materials could result in the



possible smothering of fish eggs and larvae, as well as reduce dissolved oxygen levels and increase turbidity levels.

Dredging and grading activities could also result in similar adverse impacts, including the release of toxic pollutants into the surrounding water. These activities can result in substantial impacts to fish habitat and growth, and adversely affect reproduction. The level of these impacts depends on the location, construction practice, and time of year. Smelt eggs and larvae, which may be present between January and July, are generally more susceptible to adverse environmental conditions than adult fish.

## Winter-run Chinook Salmon (*Oncorhynchus tshawytscha*)

### Status:

The winter-run chinook salmon is listed as an Endangered species by both the USFWS and CDFG.

### Description:

Chinook salmon, or king salmon as they are sometimes referred to in California, are the largest pacific salmon, sometimes exceeding 50 pounds. The Sacramento River and its tributaries in Northern California support fall, late-fall, winter, and spring runs of chinook salmon. Runs are named according to the time of year adult fish enter San Francisco Bay and begin their migration upstream to spawn (Johnson et al., 1992). Winter-run chinook salmon are generally between 22 and 36 inches long and weigh an average of approximately 12 pounds when they begin their upstream migration. They retain their bright silver appearance until late in the spawning season, turning olive-brown to dark maroon in color by spawning time. Breeding males are darker than females, have hooked jaws, and slightly humped backs.

### Distribution:

Chinook salmon spend most of their lives in the Pacific Ocean. The ocean distribution can be inferred from a limited tagging study conducted in 1969 to 1971. Data from the tagging study suggest that the ocean distribution of winter-run chinook is concentrated in California: 89 percent caught in state waters, and 11 percent in Oregon and Washington (Hallock and Reisenbichler, 1980).

Winter-run chinook salmon migrate inland via San Francisco Bay, the Sacramento-San Joaquin Delta, to the upper Sacramento River. Prior to the construction of Shasta and Keswick dams in 1945 and 1950, respectively, winter-run chinook salmon were reported to spawn in the upper reaches of the Sacramento, McCloud, and lower Pit Rivers (Moyle et al., 1980). Today, virtually all spawning occurs between Redding and Tehama on the Sacramento River. Juvenile downstream migration routes are similar to the upstream adult migration routes.

### Habitat:

Winter-run chinook require clean, free-flowing water for migration, spawning, and rearing. Cold water (temperatures less than 14°C) over clean gravel beds are essential for successful spawning (Moyle et al., 1989). Adult salmon feed primarily on fish, but rarely feed during their spawning migration.

**Project Occurrence:**

Winter-run chinook salmon are present in the Sacramento-San Joaquin Delta as adults and juveniles from as early as mid-September through mid-June. Adults are assumed to migrate upstream primarily via the mainstem Sacramento River, however, under high flow conditions they may use adjacent sloughs and tributaries through the Delta. Likewise, juveniles move down the mainstem Sacramento River but have access to sloughs and tributaries through the Delta where they rear prior to migrating to the ocean.

**Project Impact:**

Generally, adult winter-run chinook would not be expected to be adversely impacted by SB 34 levee projects. Adults use the Delta primarily as a migration corridor. Fry are the most susceptible to impacts due to their reduced avoidance abilities. Smolts are somewhat less vulnerable because they are generally more active.

Activities which could have significant adverse impacts when fry and post-fry are present include dredging and other bank stabilization projects. Dredging can release toxic pollutants into the surrounding water, reduce dissolved oxygen levels, and increase turbidity levels. Bank stabilization projects such as rip-rapping can result in the direct loss of habitat for young chinooks by removing aquatic vegetation, including dead branches and snags. These habitats are important for young chinooks and their prey. Instream structures can also result in substantial alterations of the channel and cause significant impacts to aquatic resources. The level of these impacts will depend on the location, construction practice, and time of year.

Juveniles occupy stream margins where bank cover, such as fallen trees and other debris, is plentiful. They are opportunistic drift feeders and take a wide variety of terrestrial and aquatic insects. In the Sacramento-San Joaquin Delta, terrestrial insects are by far the most important food, but crustaceans are also eaten (DFG, 1982).

#### **Life History:**

Winter-run adults mature primarily as two- and three-year-olds (25% - 2-year-olds, 67% - 3-year-olds, 8% - 4-year-olds) whereas fall, late-fall and spring runs are mainly three- and four-year-olds (Hallock and Fisher, 1985). Winter-run are also slightly smaller as returning adults compared to fish of the same age in other runs. Upstream migration begins in November and extends through June. Spawning occurs between mid-April and mid-August with most spawning activity occurring in May and June.

Winter-run chinook, are the least fecund of the four runs of Sacramento chinook, averaging 3,400 eggs per female. The eggs are deposited in river gravels where they normally incubate and hatch in less than two months (Merz, 1986). The adults die after spawning, and fry emergence begins in mid-June and continues through mid-October.

Emigration of juvenile winter-run chinook salmon from the upper Sacramento River is dependent upon streamflow conditions and water year type. The presence of juvenile winter-run as far downstream as the Sacramento-San Joaquin Delta appears to depend on storm events and turbidity of the water (Fisher, pers. comm.). Recent fisheries monitoring (1992-1995) indicates that some proportion of the juvenile winter-run population migrates en masse during fall storms. These juveniles may enter the Delta as early as mid-September. Juveniles continue to enter the Delta through May with the majority moving into the Delta from January through May. Thus juveniles spend four to seven months in the river and Delta before migrating to sea.

#### **Endangerment:**

In 1967, the Red Bluff Diversion Dam was built about 60 miles downstream of Keswick Dam, creating another impediment to winter-run chinook migration and survival. The construction of fish ladders enabled biologists to make reasonable estimates of run-sizes. As a result, the Red Bluff Diversion Dam contributed to both documenting and precipitating the decline of winter-run chinook salmon. Over 27 years the run-size has dropped from 86,000 adults in 1967-1969 to about 570 adults in 1992-1994. In the Delta, losses occur due to unscreened or poorly screened water diversions and poor flow conditions as a result of the Central Valley Project and Sate Water Project pumps in the south Delta. In general, the decline of winter-run chinook can be attributed to the loss of spawning habitat, dams and diversions, pollution, reductions in river flow, and natural environmental variability.

**Sacramento Splittail**  
*(Pogonichthys macrolepidotus)*

**Status:**

The Sacramento splittail is a Proposed-Threatened species by the USFWS.

**Description:**

The Sacramento splittail is a native minnow that commonly grows 12 to 16 inches in length. The fish are silvery gold on the sides and olive gray dorsally. Splittails are most easily recognized by the upper lobe of their caudal fin, which is considerably longer than the lower lobe. Small barbels may be present on either side of their slightly subterminal mouth. During the breeding season, they exhibit a red-orange hue on the caudal, pectoral, and pelvic fins, and males become darker and develop tiny white tubercles in the head region. The Sacramento splittail is the only surviving member of its genus.

**Distribution:**

Sacramento splittail were historically known to occur in lakes and rivers throughout the Central Valley. They were found as far north as Redding in Shasta County (Rutter, 1908), but are no longer found there and are limited by the Red Bluff Diversion Dam to the downstream reaches of the Sacramento River. They have also been known to enter the lower reaches of the Feather and American rivers on occasion.

Today, splittail are largely confined to the Delta, Suisun Bay, Suisun Marsh, Napa Marsh, and other parts of the Sacramento-San Joaquin Estuary (Caywood, 1974; Moyle, 1976). Occasionally splittail are caught in San Luis Reservoir (Caywood, 1974) which stores water pumped from the Delta. They are not very common in the Sacramento River area north of the Delta, although a few individuals may be found in the spring, presumably during spawning.

**Habitat:**

Splittail are primarily freshwater fish, but, unlike other members of the minnow family, tolerate moderately brackish water with salinities of 10-12 parts per thousand (Moyle, 1976). They live mostly in the slow-moving stretches of rivers and sloughs. In the Delta and Suisun Marsh, splittail typically congregate in dead-end sloughs which have small stream tributaries (Moyle, 1992). Their usual habitat is lined with emergent vegetation, as this offers protection from larger fish and provides an abundant food source.

Spawning occurs in the lower reaches of rivers (Caywood, 1974), dead-end sloughs (Moyle, 1976), and in some of the larger sloughs (Wang, 1986). The fish spawn over submerged

result in adverse impacts due to increases in suspended sediments and the potential smothering of fish eggs and larvae at sites downstream or upstream, depending on tidal conditions.

Dredging activities can also result in similar adverse impacts. These activities can result in a reduction of dissolved oxygen levels in the water, increase turbidity levels, and release toxic pollutants into the surrounding water. The level of these impacts would depend on the location, construction practice, and time of year. Splittail eggs and larvae are generally the most susceptible to adverse environmental conditions.

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vegetation in flooded areas, and the larvae remain in these shallow, weedy areas to feed (Caywood, 1974; Wang, 1986). The young will move into deeper offshore habitats as they mature.

Splittail are benthic foragers that feed on a variety of organisms, primarily opossum shrimp (*Neomysis mercedia*). They also feed opportunistically on earthworms, insect larvae, and detritus.

### **Life History:**

There has been some variability in the reproductive period of the Sacramento splittail, with older fish spawning first, followed by younger fish which tend to spawn later in the season (Caywood, 1974). In general, spawning occurs in late April and May in the bay marshes (Daniels and Moyle, 1983) and between early March and May in the upper Delta (Caywood, 1974). Wang (1986) also noted spawning taking place as early as late January and continuing through July.

A single female splittail can lay more than 100,000 eggs, which is more than many freshwater species. The eggs sink to the bottom and adhere to vegetation or rocks. Newly hatched larvae remain in the nesting area for several days until their yolk sac is absorbed, then swim freely into the shallows where they will forage. Splittail are relatively long-lived (about five to seven years) and reach sexual maturity by their second year.

### **Endangerment:**

The Sacramento splittail has disappeared from much of its native range as a result of dams, water diversions, and agricultural development. The Red Bluff Diversion Dam on the Sacramento River, the Nimbus Dam on the American River, and the Oroville Dam on the Feather River block access to historic spawning habitats upstream. They are currently threatened due to prolonged drought conditions, water diversions, and introduced aquatic species. Channelization and bank stabilization projects that eliminate potential spawning areas in the Delta may further contribute to population declines.

### **Project Occurrence:**

Adult and juvenile splittail may be present throughout the year in the Sacramento-San Joaquin Delta system. Although they may be evenly distributed throughout the Delta, a 1987 DFG study found them most abundant in the northern and western regions of the Delta on flooded island areas.

### **Project Impact:**

SB 34 projects that affect or remove streambank vegetation may result in the loss of potential spawning and rearing habitat for the splittail. Installation of revetments or riprap may also

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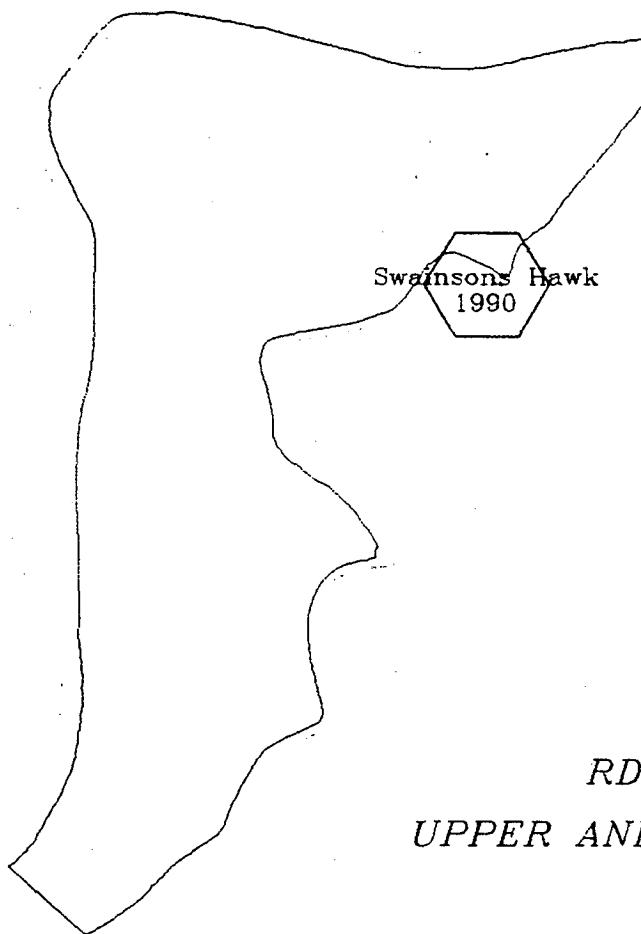
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**APPENDIX F**

**SENSITIVE SPECIES  
LOCATION MAPS**



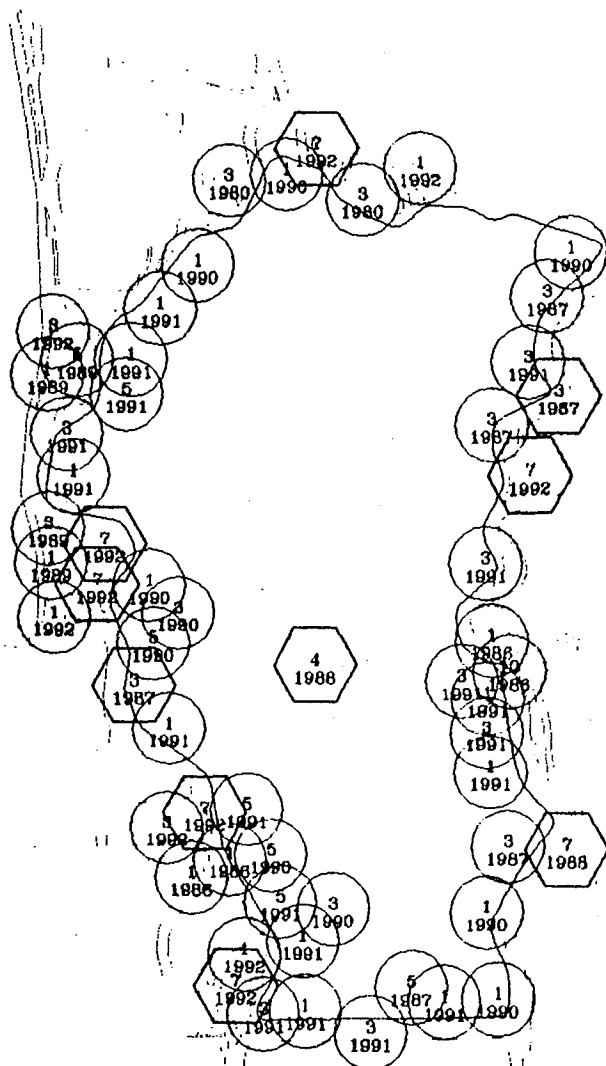
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UPPER ANDRUS ISLAND

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM

DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED: MARCH 1995



IDENTIFICATION KEY	
ANIMALS	PLANTS
3 WESTERN POND TURTLE	1 MASON'S LILACOPSIS
4 BURROWING OWL	3 CALIFORNIA HIBISCUS
7 CALIFORNIA BLACK RAIL	5 SUISUN MARSH ASTER
	10 DELTA MUDWORT

## RD 2028 BACON ISLAND

DEPARTMENT OF WATER RESOURCES  
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C-056711

C-056711





4  
1985

1  
1990

3  
1987

IDENTIFICATION KEY	
ANIMALS	PLANTS
1 SWAINSON'S HAWK	3 CALIFORNIA HIBISCUS
4 BURROWING OWL	

RD 2042  
BISHOP TRACT

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM

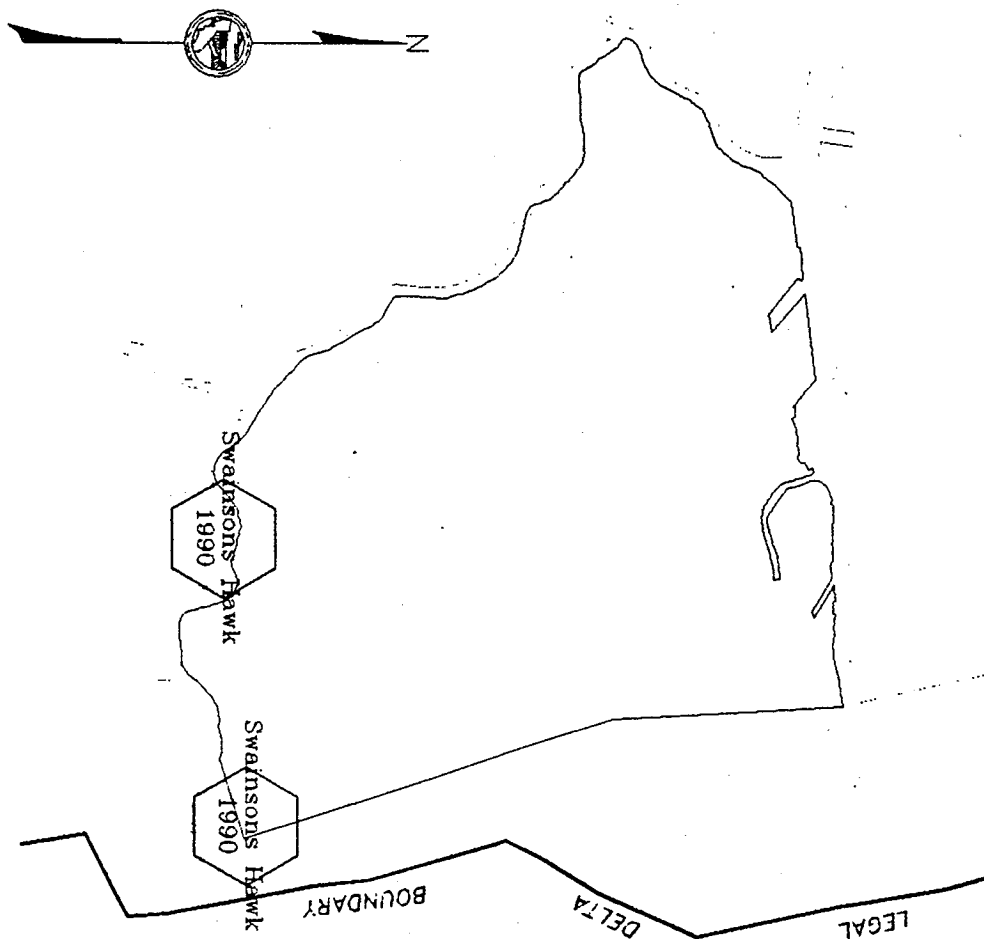
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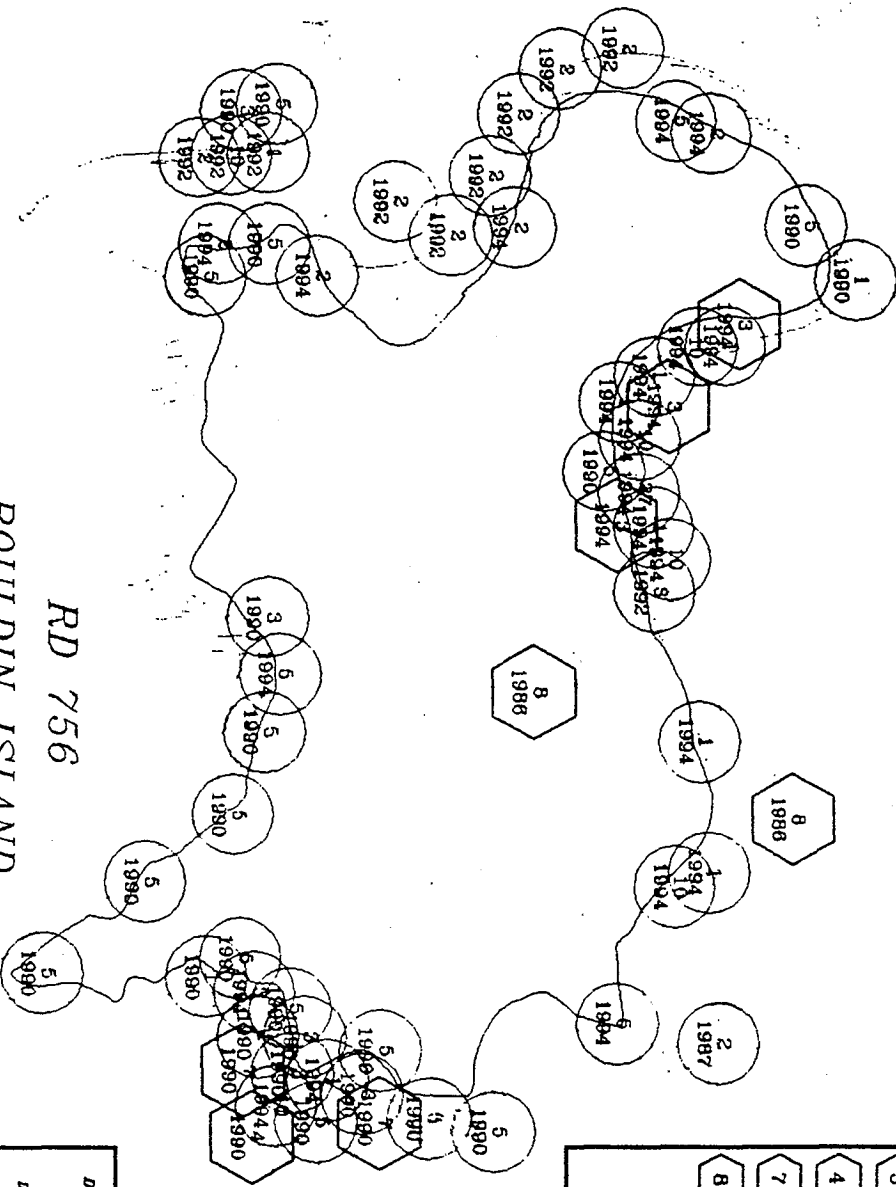
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DELTA LEVEL SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES  
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DEPARTMENT OF WATER RESOURCES  
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BOULDIN ISLAND

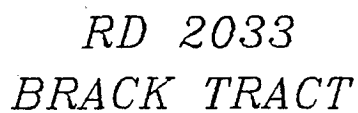
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IDENTIFICATION KEY	
ANIMALS	PLANTS
3 BOTTLE NOSE TURTLE	1 NATIVE LILIES
4 BOMBING OIL	2 DELTA TULE REED
7 CALIFORNIA BLACK RAIL	3 CALIFORNIA REDWING
8 GREATER SANDHILL CRAN	5 SAGEWY MARSH ALDER
	10 DELTA REDWING
	27 MARSH BENTGRASS

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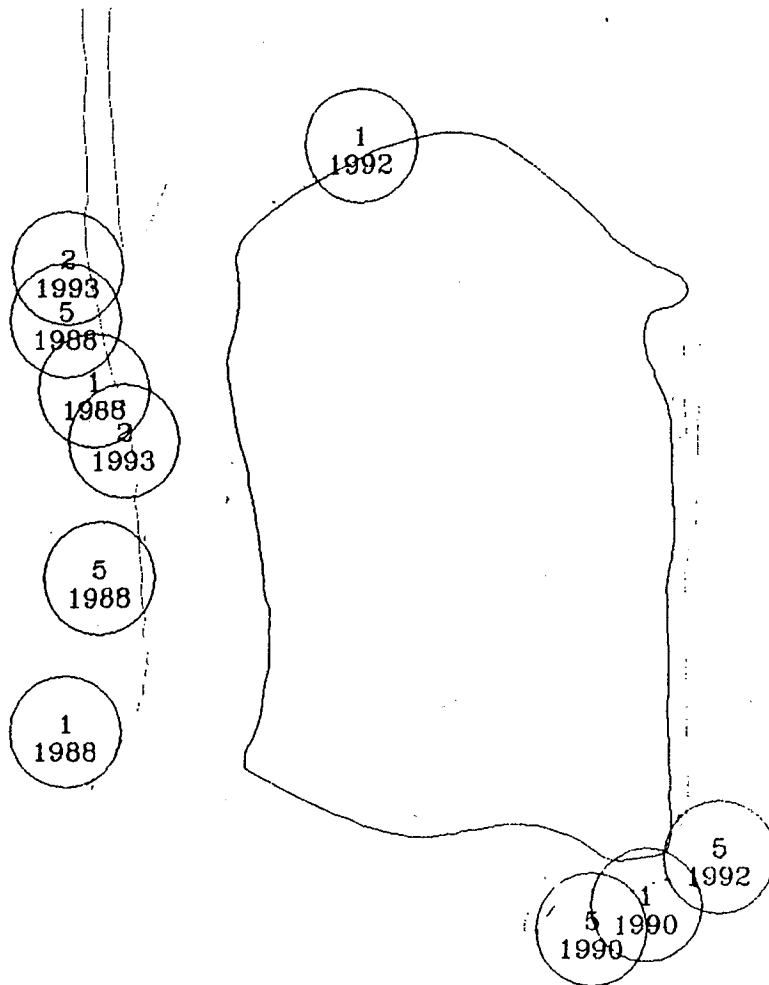


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DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM

### DISTRIBUTION OF SPECIAL STATUS SPECIES

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CENTRAL DISTRICT

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#### IDENTIFICATION KEY

##### PLANTS

1

MASON'S  
LILAEOPSIS

3

CALIFORNIA  
HIBISCUS

5

SUISUN MARSH  
ASTER

## RD. 2059 BRADFORD ISLAND

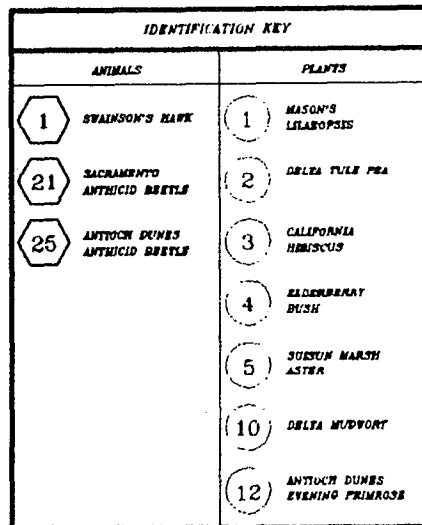
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DISTRIBUTION OF SPECIAL STATUS SPECIES

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CENTRAL DISTRICT

REVISED MARCH 1995

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C-056717

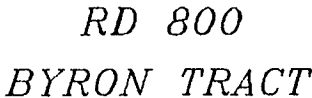


BALMD  
LOWER BRANNAN-ANDRUS  
ISLAND

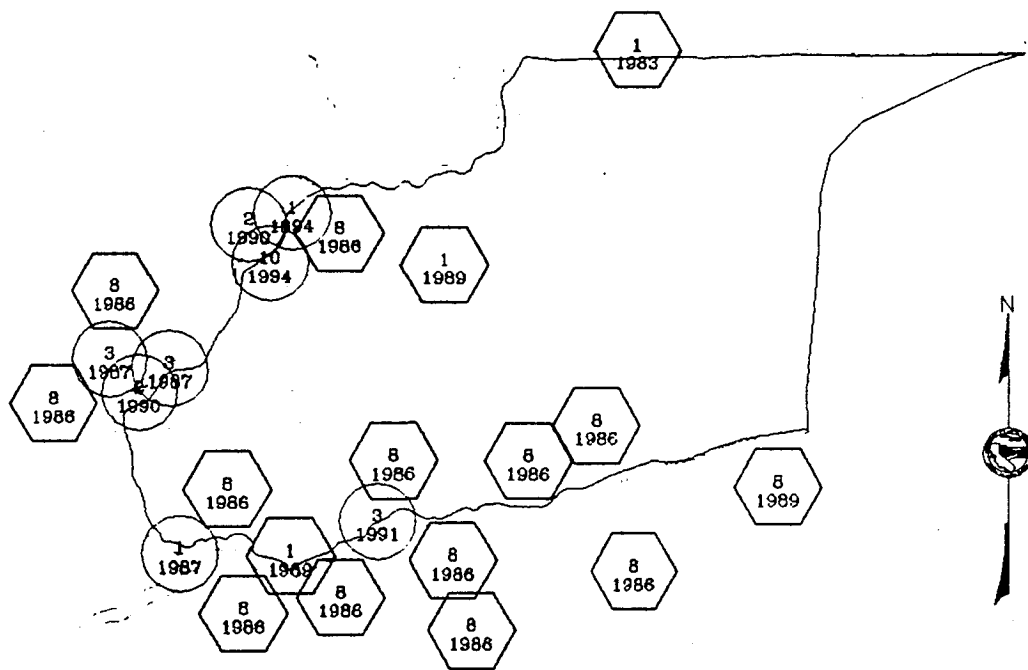
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DEPARTMENT OF FISH AND GAME  
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DISTRIBUTION OF SPECIAL STATUS SPECIES

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DISTRIBUTION OF SPECIAL STATUS SPECIES  
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CENTRAL DISTRICT  
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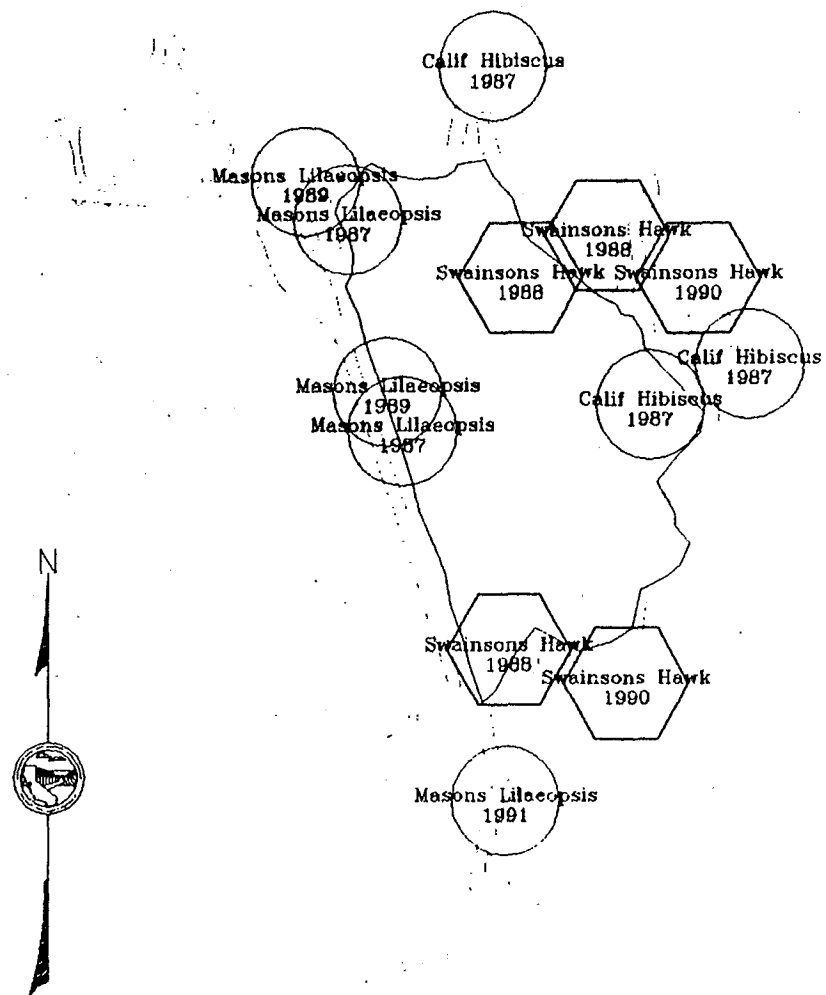
RD 2086  
CANAL RANCH TRACT

IDENTIFICATION KEY	
ANIMALS	PLANTS
1 SWANSON'S HAWK	1 MASON'S LILAEOPSIS
8 GREATER SANDHILL CRANE	2 DELTA TULIP PEA
	3 CALIFORNIA HYDRANGEA
	10 DELTA MUDWORM

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
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CONEY ISLAND

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DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED MARCH 1995



Valley Elderberry 1992

Valley Elderberry 1992

Valley Elderberry 1992

Valley Elderberry 1993

Valley Elderberry Longhorn Beetle 1992

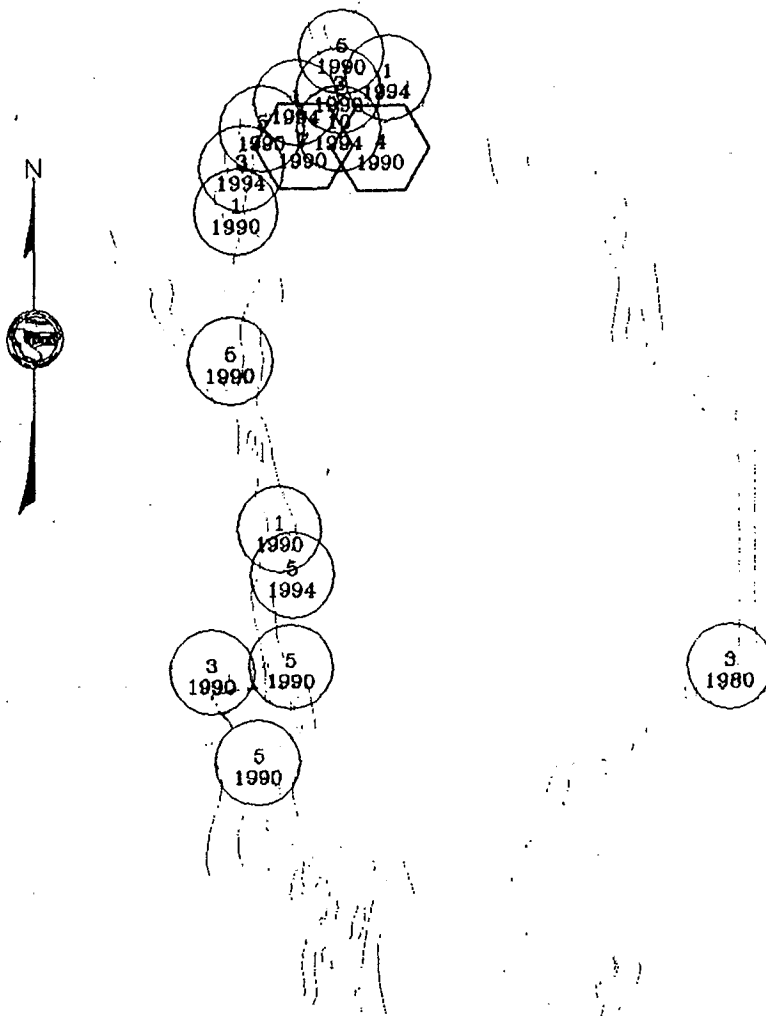
Valley Elderberry 1993

# RD 2111 DEADHORSE ISLAND

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED: MARCH 1996



IDENTIFICATION KEY	
ANIMALS	PLANTS
4 BURROWING OWL	1 MASON'S ELIASOPHIS
7 CALIFORNIA BLACK RAIL	3 CALIFORNIA NIBISCUS
	5 SUISUN MARSH ASTER
	10 DELTA MUDWORT

RD 2029  
EMPIRE TRACT

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

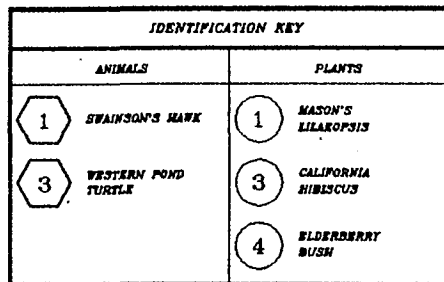
PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED: MARCH 1995

C-056723

C-056723





DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

REVISED: MARCH 1995



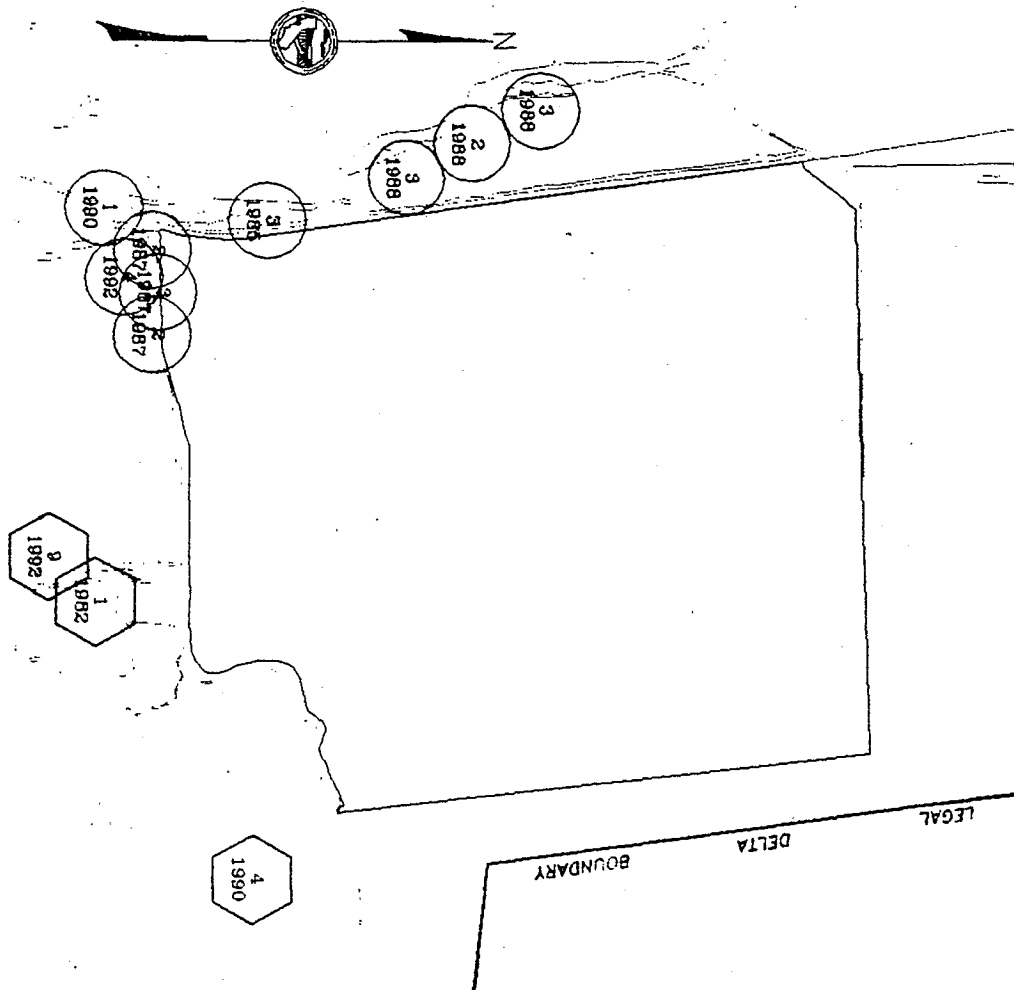
RD 2113  
FAY ISLAND

**REVISED: MARCH 1995**

IDENTIFICATION KEY			
ANIMALS		PLANTS	
1	SWAINSON'S HAWK	1	MASON'S LILAOPSIS
4	BURROWING OWL	2	DELTA TULE PEA
9	VALLEY ELDERBERRY LONGHORN BEETLE	3	CALIFORNIA HIBISCUS
		4	ELDERBERRY BUSH

# RD 1002 CLANVILLE TRACT

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEL SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES  
PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT  
REVISED: MARCH 1995



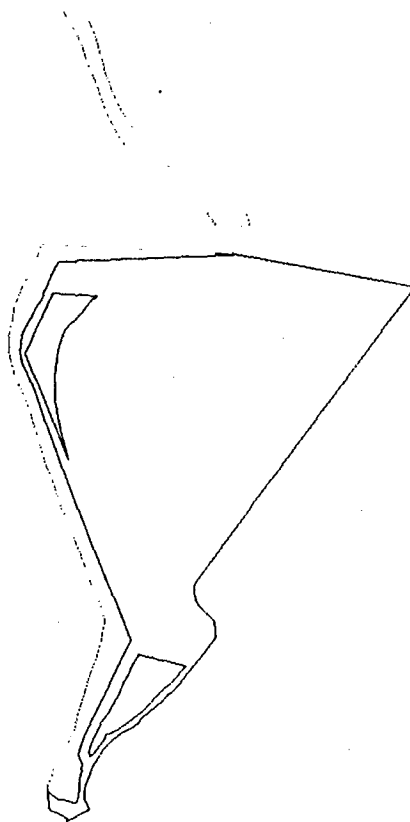


RD 2025  
HOLLAND TRACT

REVISED: MARCH 1996

*NO SPECIAL STATUS SPECIES FOUND  
WITHIN 1000 METER RADIUS  
OF DISTRICT'S PERIMETER*

*RD 2116  
HOLT STATION*



*DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM*

*DISTRIBUTION OF SPECIAL STATUS SPECIES*

*PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT*

*REVISED: MARCH 1995*



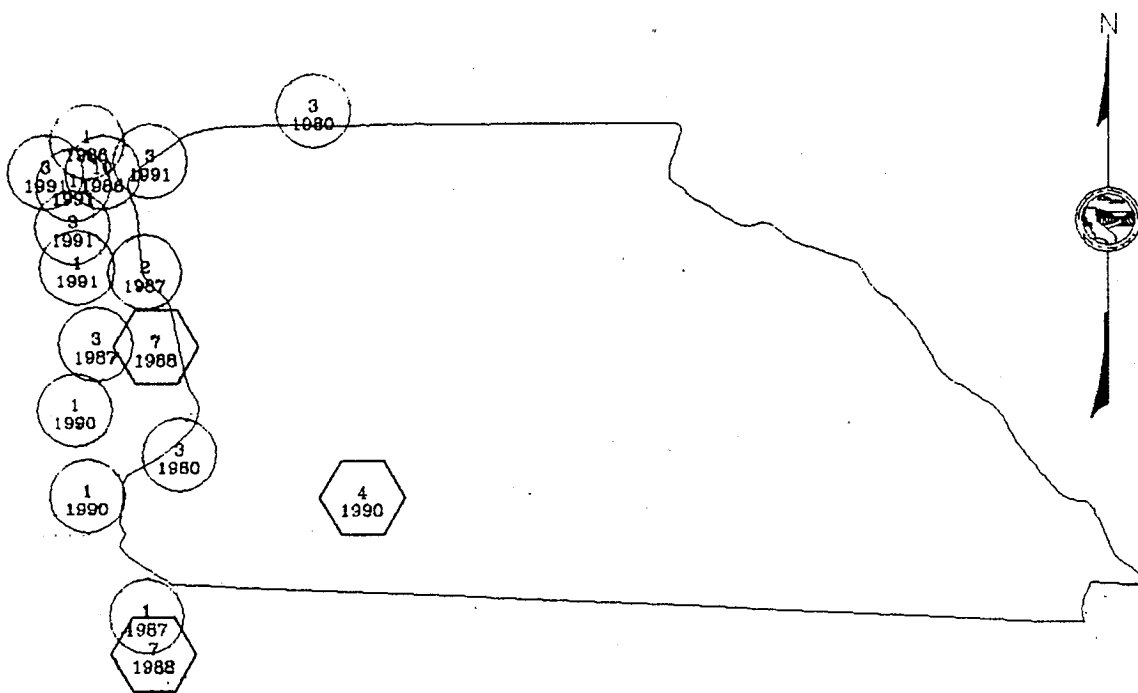
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ANIMALS	PLANTS
4 BURROWING OWL	1 MASON'S LILAEOPSIS
11 KIT FOX	10 DELTA MUDWORT

RD 799  
HOTCHKISS TRACT

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

**REVISED: MARCH 1995**



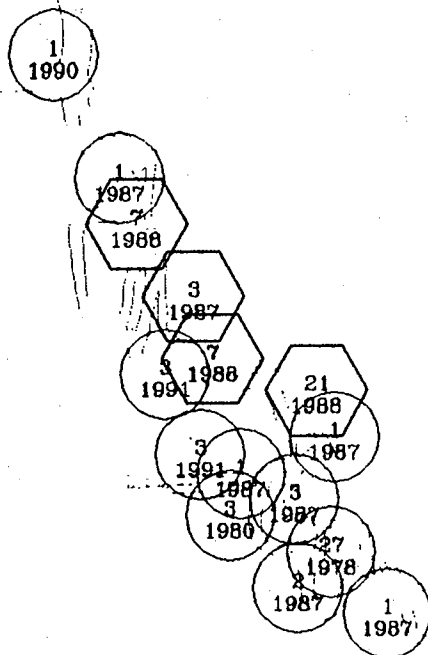
IDENTIFICATION KEY	
ANIMALS	PLANTS
4 BURROWING OWL	1 MASON'S LILAEOPSIS
7 CALIFORNIA BLACK RAIL	2 DELTA TULE PEA
	3 CALIFORNIA HIBISCUS
	10 DELTA MUDWORT

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM

### DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

**REVISED: MARCH 1995**



IDENTIFICATION KEY	
ANIMALS	PLANTS
3 WESTERN FOND TURTLE	1 MASON'S LILAEOPSIS
7 CALIFORNIA BLACK RAIL	2 DELTA TULE PEA
21 SACRAMENTO ANTHICID BEETLE	3 CALIFORNIA HIBISCUS
	27 MARSH SKULLCAP

RD 2039  
UPPER JONES TRACT



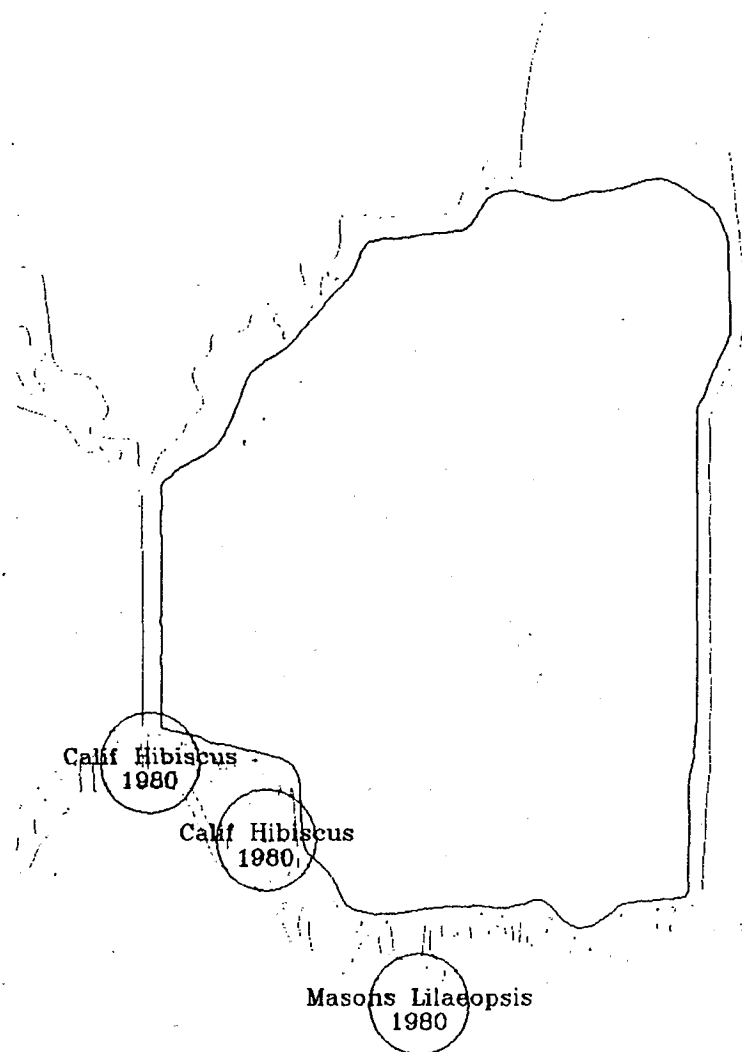
DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES  
PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT  
REVISED: MARCH 1986

C-056731

C-056731



RD 2044  
KING ISLAND



DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM

DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED, MARCH 1995

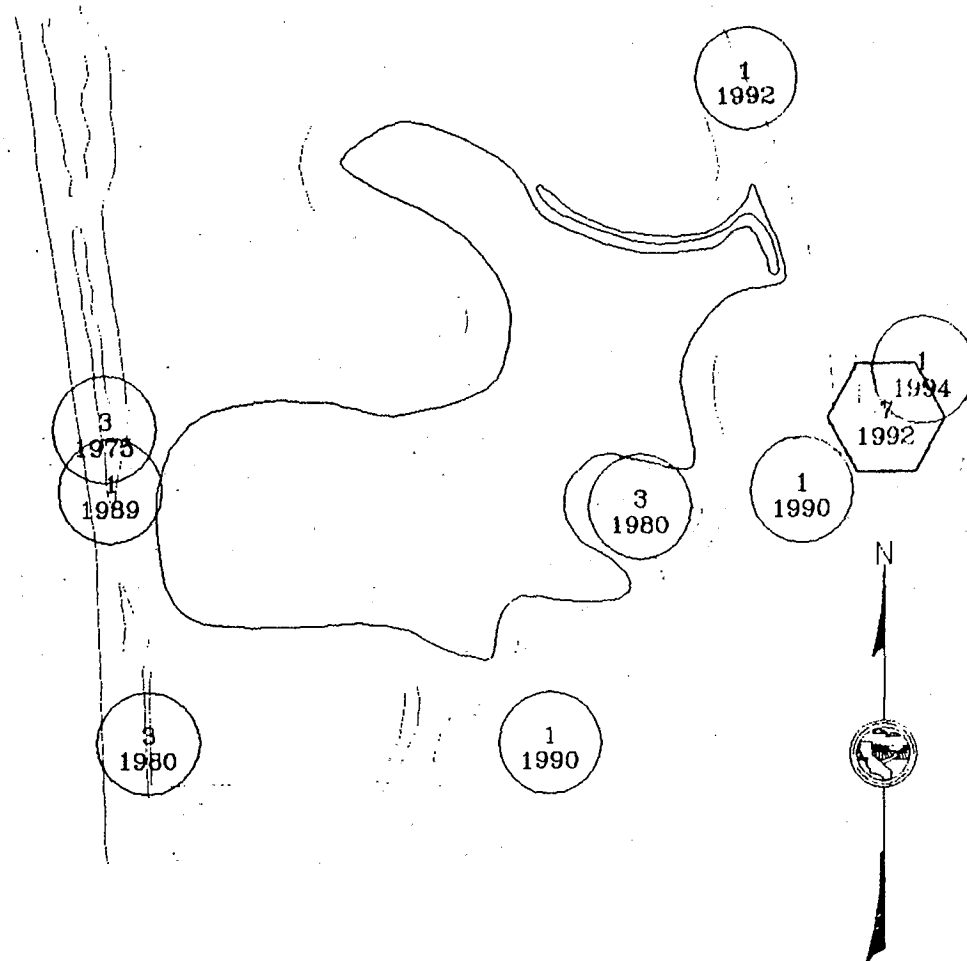
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ANIMALS	PLANTS
7 CALIFORNIA BLACK RAIL	1 MASON'S LILAEOPSIS
	3 CALIFORNIA HIBISCUS

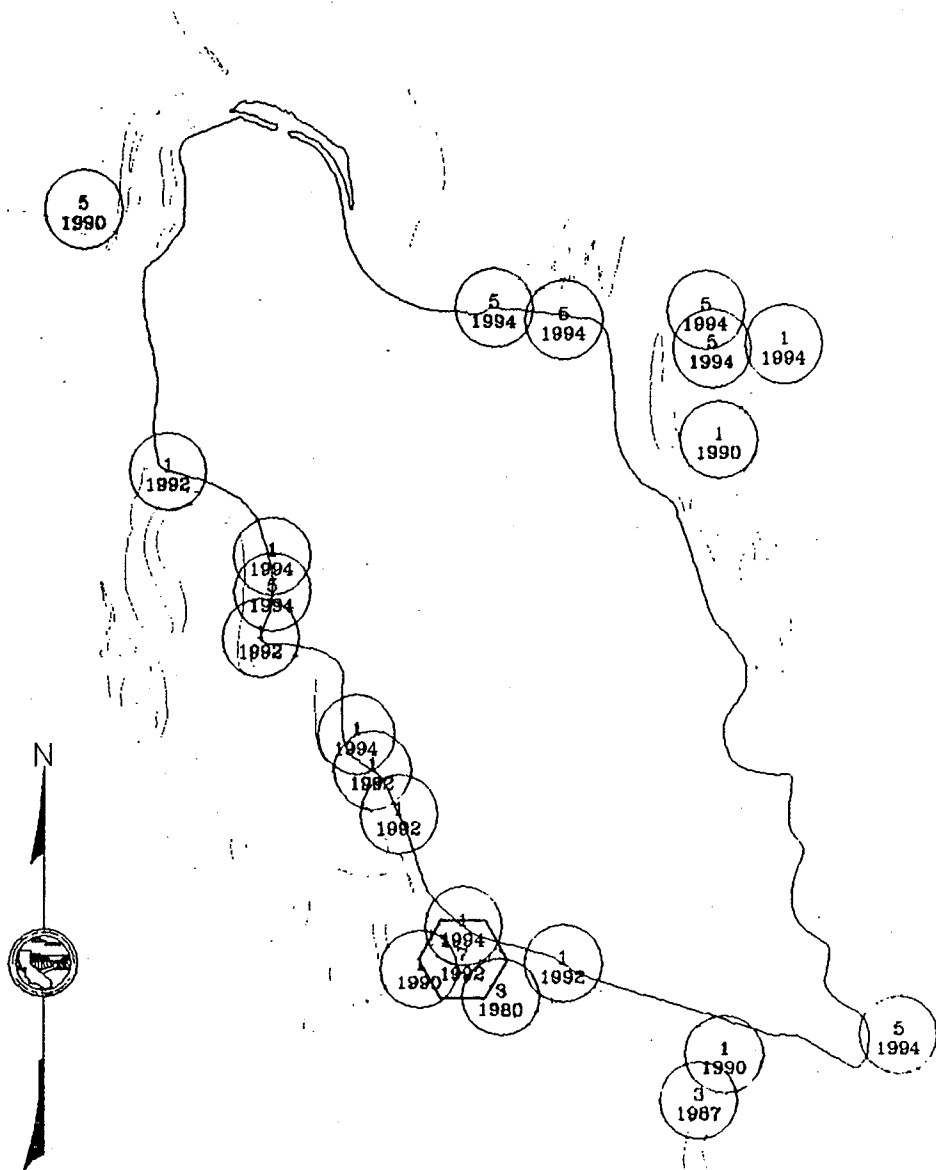
RD 2118  
LITTLE MANDEVILLE ISLAND

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

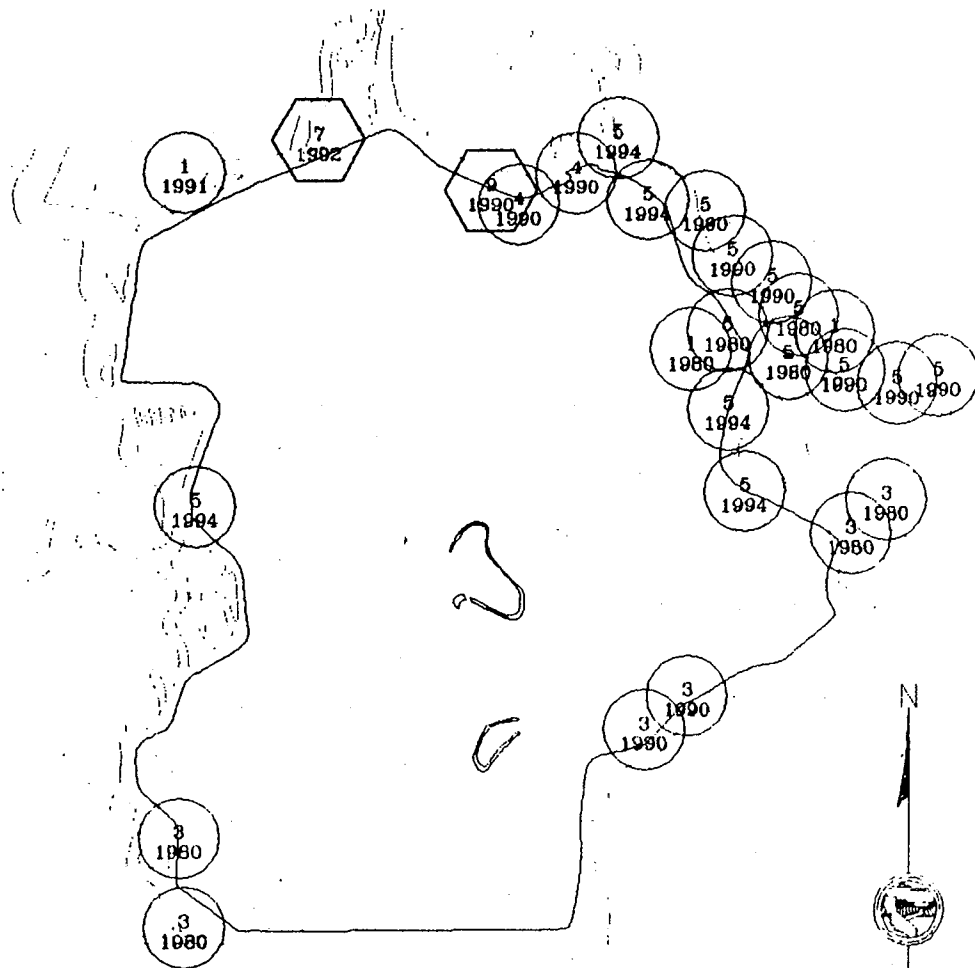
REVISED: MARCH 1995





RD 2027  
MANDEVILLE ISLAND

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES  
PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT  
REVISED: MARCH 1995



IDENTIFICATION KEY	
ANIMALS	PLANTS
<div>7</div> CALIFORNIA BLACK RAIL	<div>1</div> MASON'S LILAEOPSIS
<div>9</div> VALLEY ELDERBERRY LONGHORN BEETLE	<div>3</div> CALIFORNIA HIBISCUS
	<div>4</div> ELDERBERRY BUSH
	<div>5</div> SUISUN MARSH ASTER

RD 2030  
McDONALD ISLAND

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM

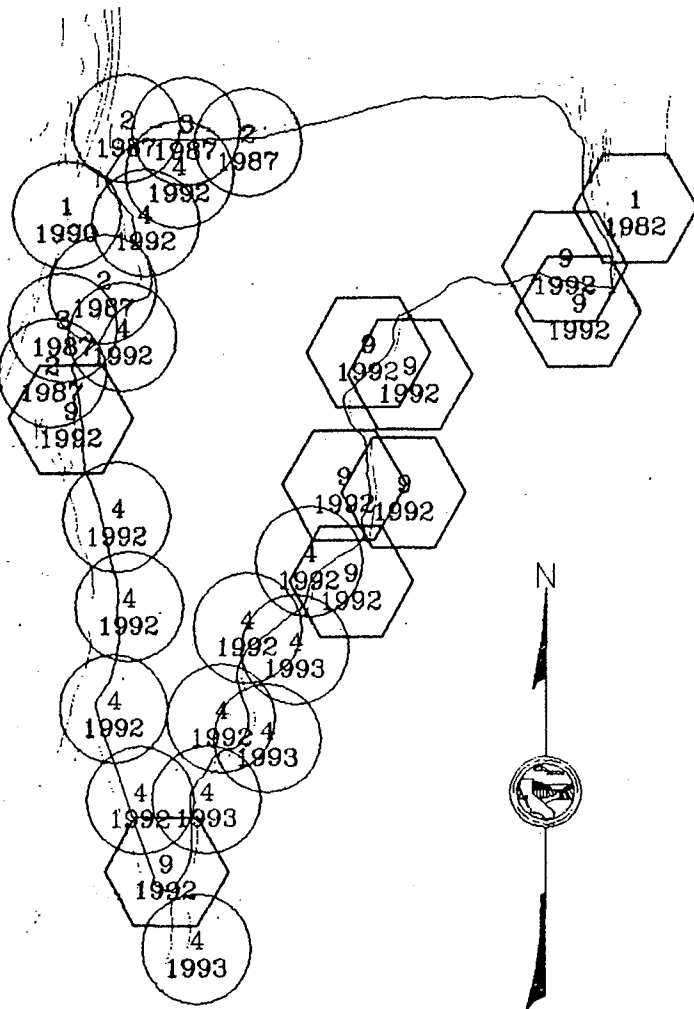
DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED: MARCH 1995

C-056735

C-056735



IDENTIFICATION KEY	
ANIMALS	PLANTS
1 SWAINSON'S HAWK	1 MASON'S LILAEOPSIS
9 VALLEY ELDERBERRY LONGHORN BEETLE	2 DELTA TULE PEA
	3 CALIFORNIA HIBISCUS
	4 ELDERBERRY BUSH

RD 2110  
McCORMACK-WILLIAMSON  
TRACT

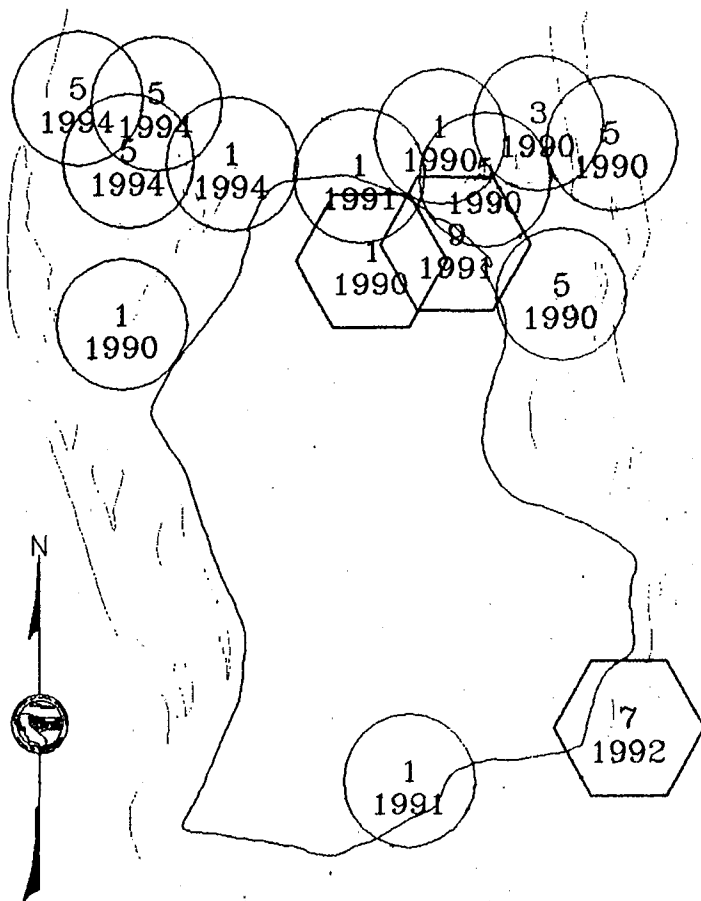
DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED: MARCH 1995

C-056736

C-056736



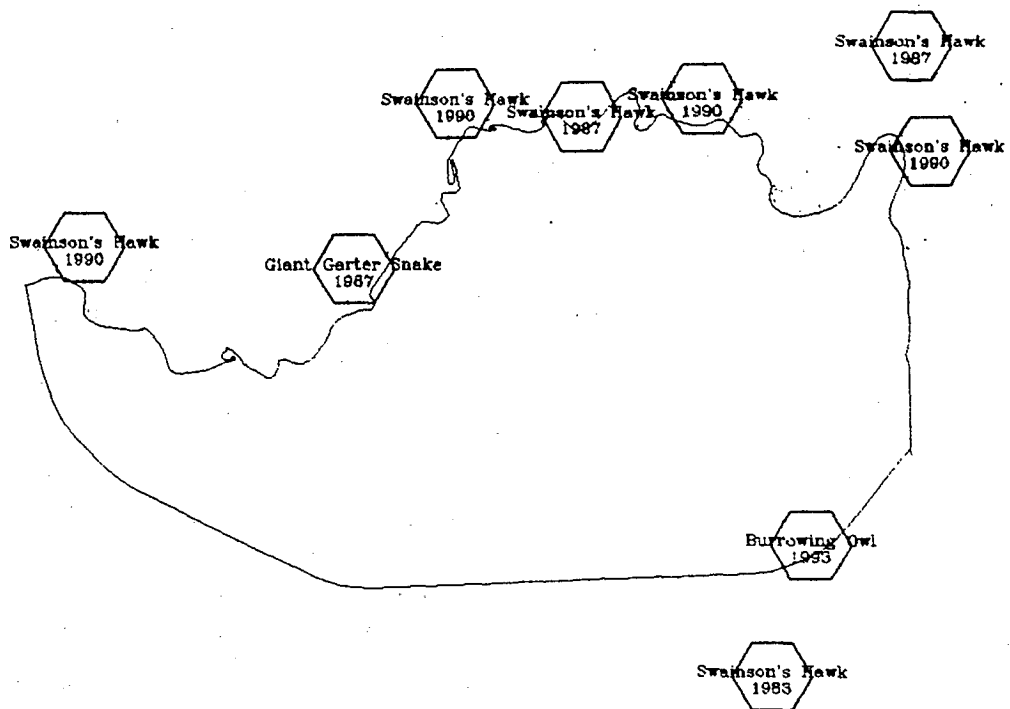
IDENTIFICATION KEY	
ANIMALS	PLANTS
1 SWAINSON'S HAWK	1 MASON'S LILAEOPSIS
7 CALIFORNIA BLACK RAIL	3 CALIFORNIA HIBISCUS
9 VALLEY ELDERBERRY LONGHORN BEETLE	5 SUISUN MARSH ASTER

# RD 2041 MEDFORD ISLAND

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED: MARCH 1995

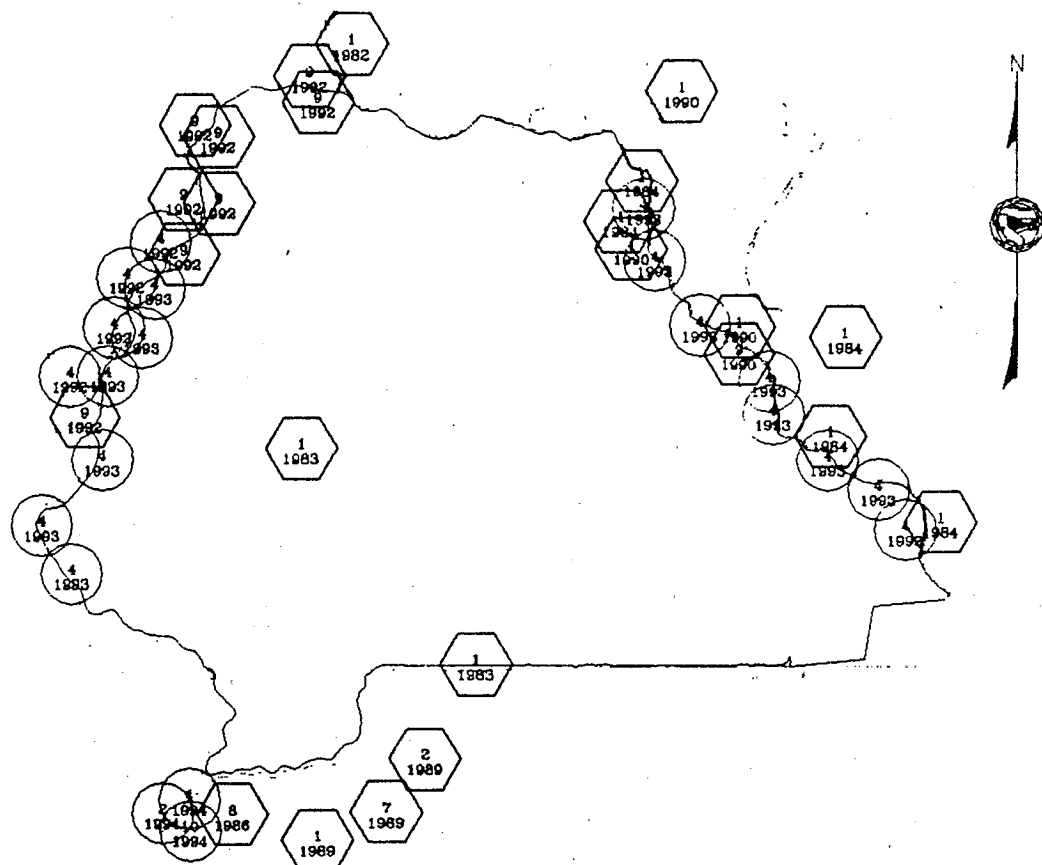


RD 1007  
NAGLEE BURKE TRACT

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED: MARCH 1996

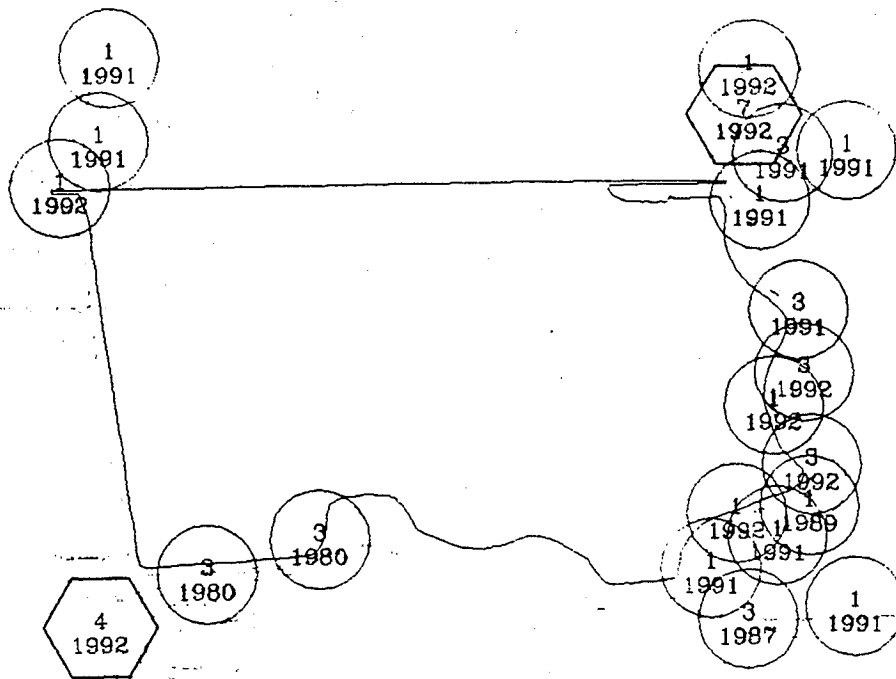


# RD 348 NEW HOPE TRACT

IDENTIFICATION KEY	
ANIMALS	PLANTS
1 SWANSON'S HAWK	1 MASON'S LILAEOPSIS
2 GIANT GARTER SNAIL	2 DELTA TULE PEA
7 CALIFORNIA BLACK RAIL	4 ELDERBERRY BUSH
8 GREAT SANDHILL CRANE	10 DELTA MUDWORT
9 VALLEY ELDERBERRY LONGHORN BEETLE	

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES  
PREPARED BY  
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CENTRAL DISTRICT  
REVISED, MARCH 1996





RD 2024  
ORWOOD TRACT

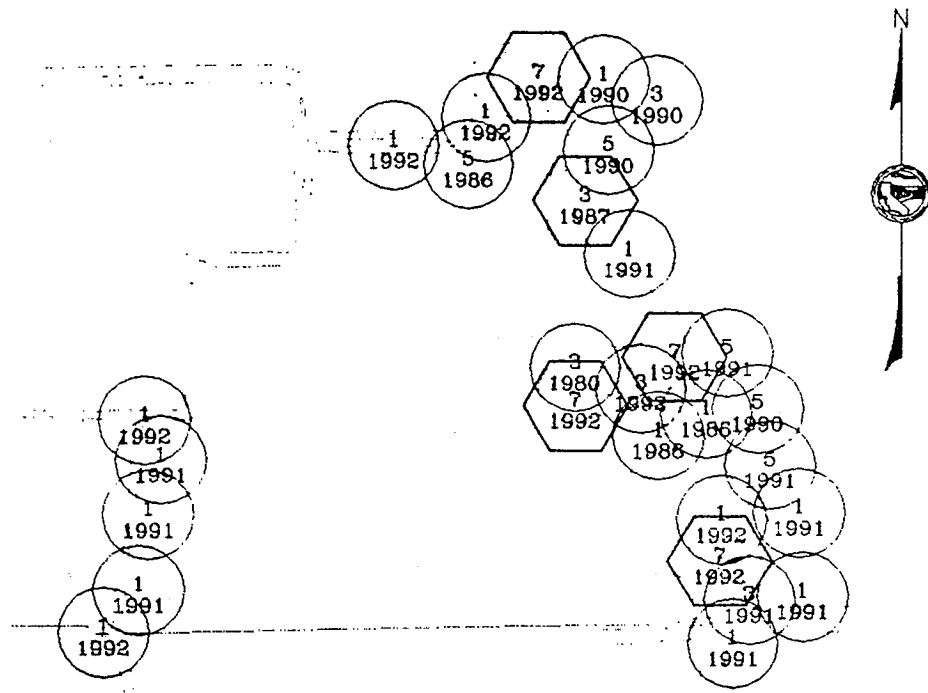


IDENTIFICATION KEY	
ANIMALS	PLANTS
<div>4</div> BURROWING OWL	<div>1</div> MASON'S LILAEOPSIS
<div>7</div> CALIFORNIA BLACK RAIL	<div>3</div> CALIFORNIA HIBISCUS






DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

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CENTRAL DISTRICT

REVISED: MARCH 1995



RD 2036  
PALM TRACT

IDENTIFICATION KEY	
ANIMALS	PLANTS
 WESTERN POND TURTLE	 MASON'S ELAEOPHYTES
 CALIFORNIA BLACK RAIL	 CALIFORNIA HIBISCUS
	 SUTSUN MARSH ASTER

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED, MARCH 1995

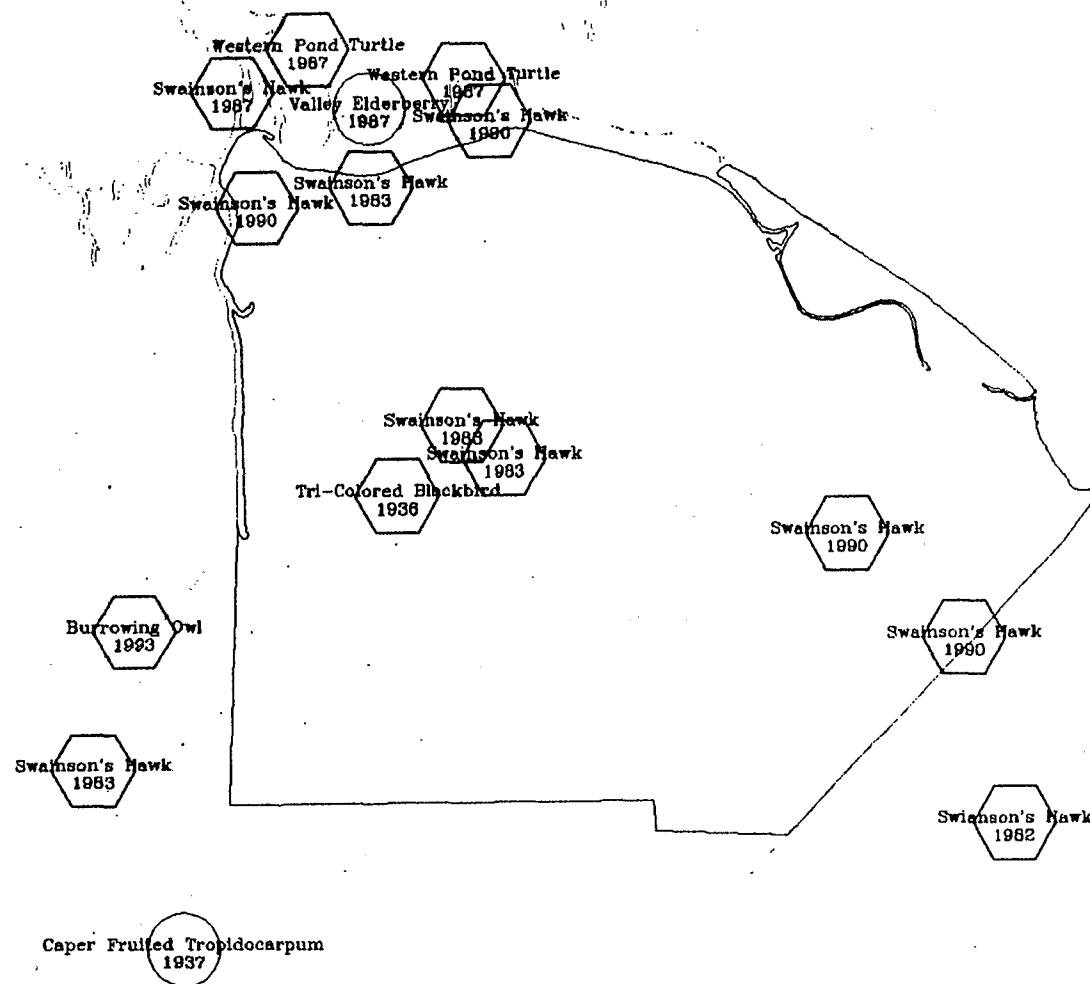
DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM

DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED: MARCH 1995

RD 2058  
PESCADERO TRACT





RD 1667

# PROSPECT ISLAND

Delta Tule Pea

1988

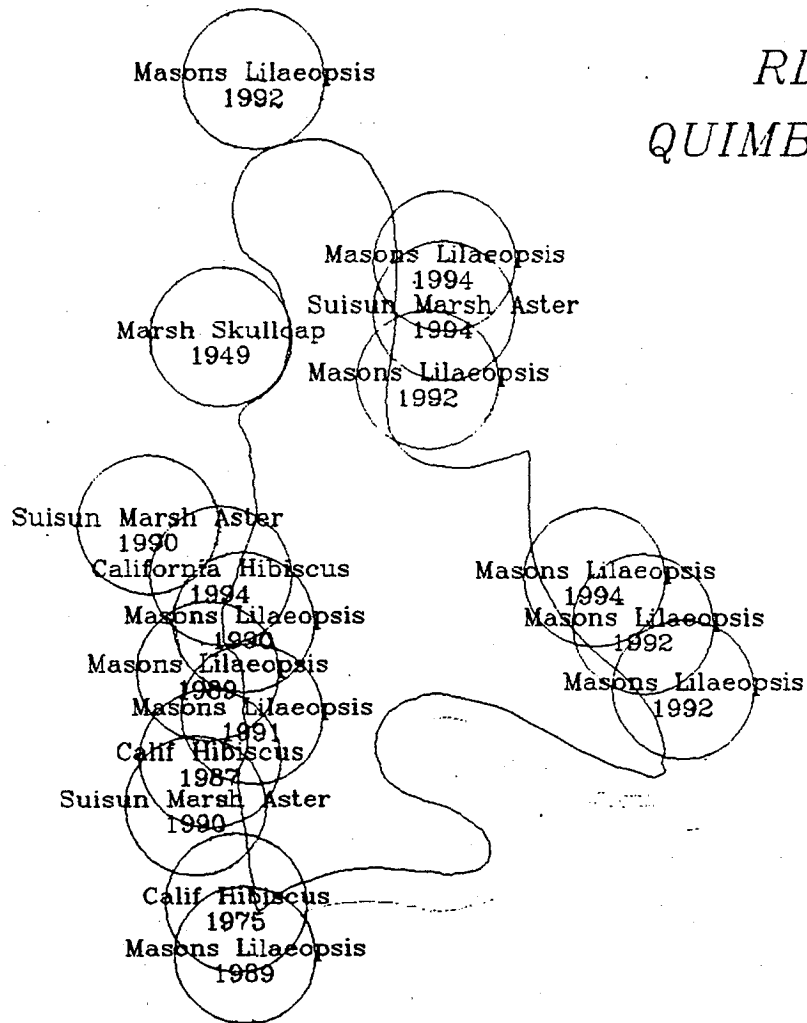
Masons Liliopsis

1988

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

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CENTRAL DISTRICT  
REVISED: MARCH 1995

RD 2090  
QUIMBY ISLAND

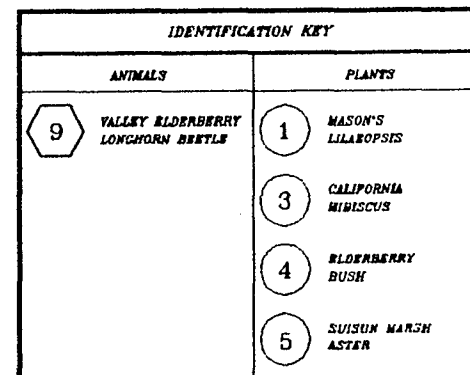


DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM

DISTRIBUTION OF SPECIAL STATUS SPECIES

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DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED: MARCH 1995



RD 2037  
RINDGE TRACT

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

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CENTRAL DISTRICT

REVISED: MARCH 1986

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

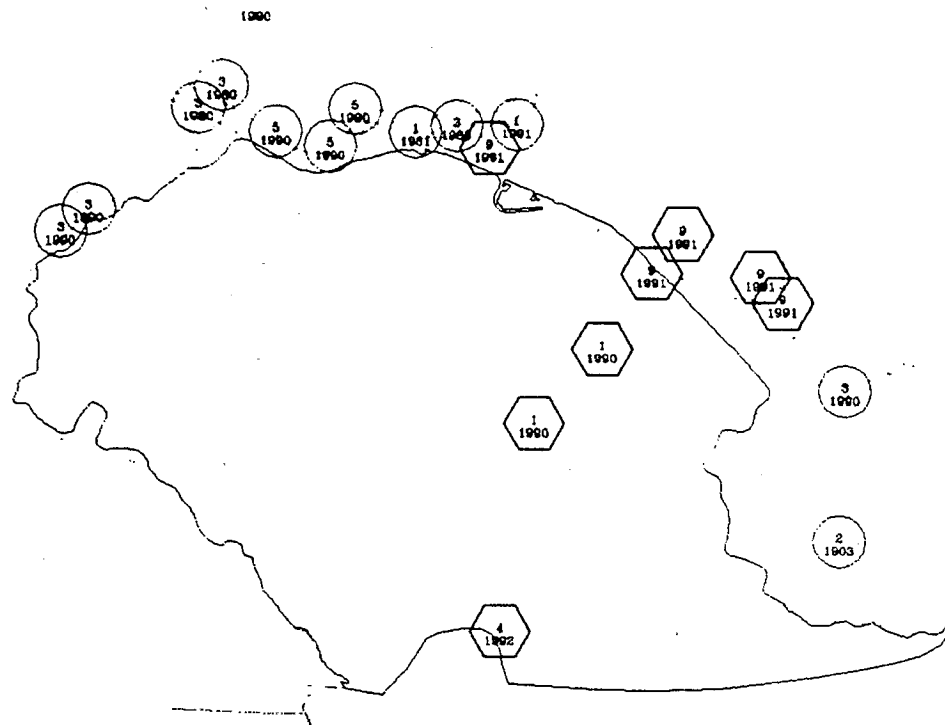
PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED: MARCH 1995



Burrowing Owl  
1985

RD 2114  
RIO BLANCO TRACT



RD 684  
LOWER ROBERTS ISLAND

IDENTIFICATION KEY	
ANIMALS	PLANTS
1 STEARNS' SPARROW	1 MARSH SPARROW
4 BURROWING OWL	2 DELTA TULE WREN
9 VALLEY ELDERBERRY LONGHORN BEETLE	3 CALIFORNIA QUAIL
	5 WESTERN MEADOW LARK

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

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CENTRAL DISTRICT

REVISED: MARCH 1995





4  
1992

1  
1991

1  
1990

1  
1992

4  
1993

1  
1990

14  
1972

1978  
1979  
1980  
1981  
1982

IDENTIFICATION KEY	
ANIMALS	PLANTS
1 SWAINSON'S HAWK	3 CALIFORNIA WINKSCUS
4 BURROWING OWL	
14 TEN-COLORED BLACKBIRD	

RD 524  
MIDDLE ROBERTS ISLAND

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM

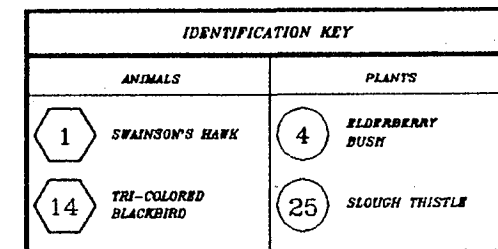
DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED, MARCH 1996

C-056748

C-056748



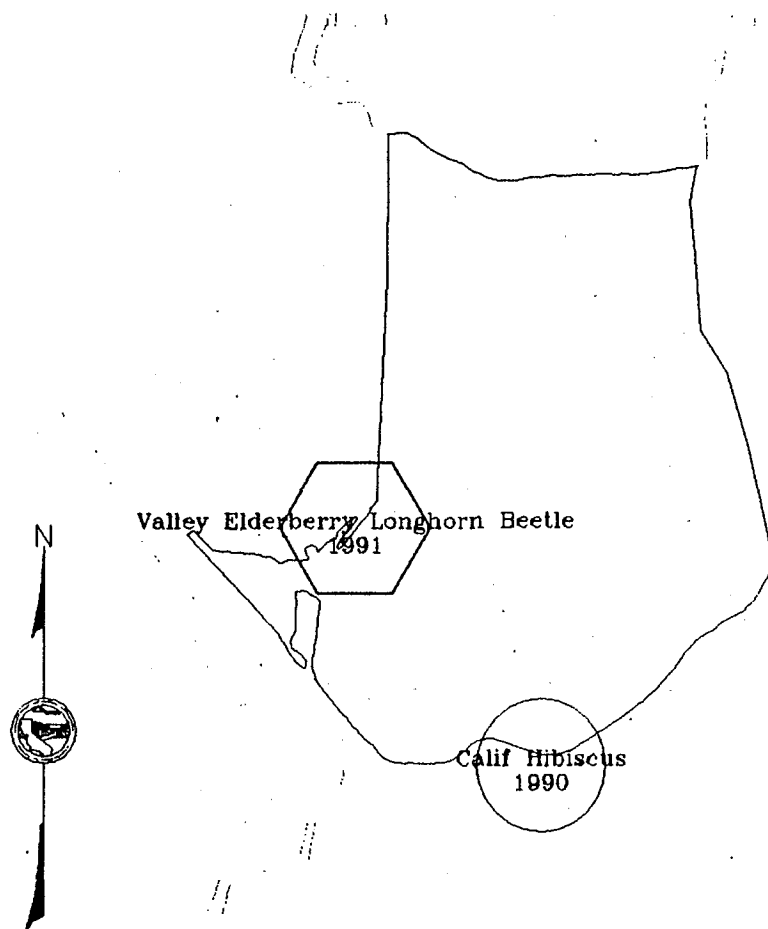
RD 544  
UPPER ROBERTS ISLAND

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

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CENTRAL DISTRICT

REVISÉD· MARCH 1995

RD 2074  
SARGENT-BARNHART TRACT



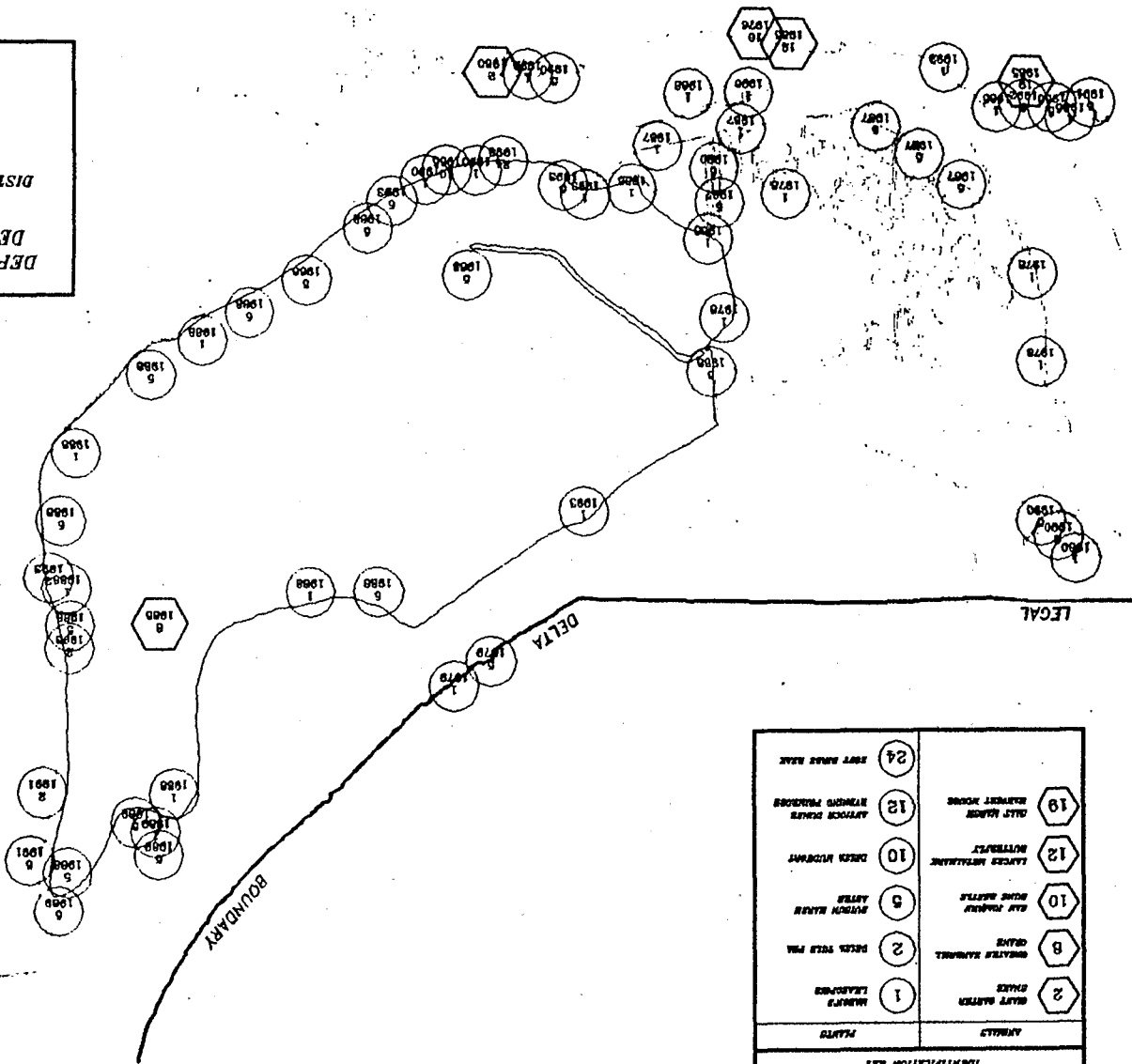
DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

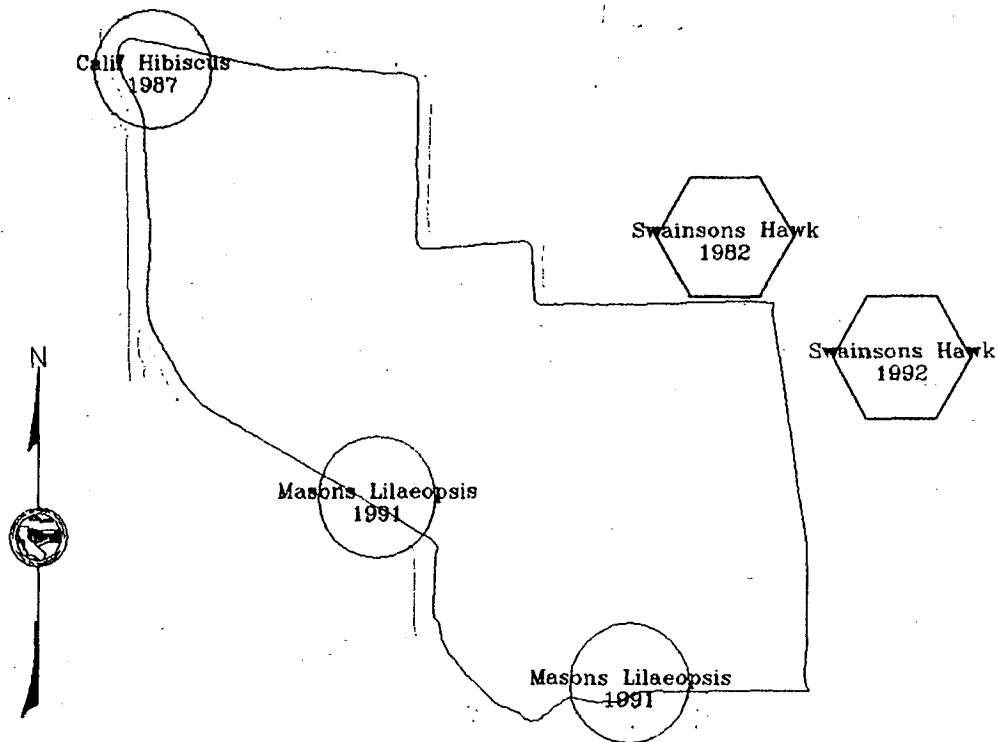
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CENTRAL DISTRICT

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DEPARTMENT OF WATER RESOURCES  
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 DELTA LEVEL SUBVENTION PROGRAM  
 DISTRIBUTION OF SPECIAL STATUS SPECIES  
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 CENTRAL DISTRICT  
 REVISED: MARCH 1995

RD 341  
 SHERMAN ISLAND





*RD 2115  
SHIMA TRACT*

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

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CENTRAL DISTRICT

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C-056752

C-056752



Calif Hibiscus  
1990

Burrowing Owl  
1990

Swainson's Hawk  
1990  
Burrowing Owl  
1990

Swainson's Hawk  
1990

Swainson's Hawk  
1992  
Calif Tiger Salamander  
1993  
Burrowing Owl  
1991

LEGAL

DELTA

BOUNDARY

RD 1614  
SMITH TRACT

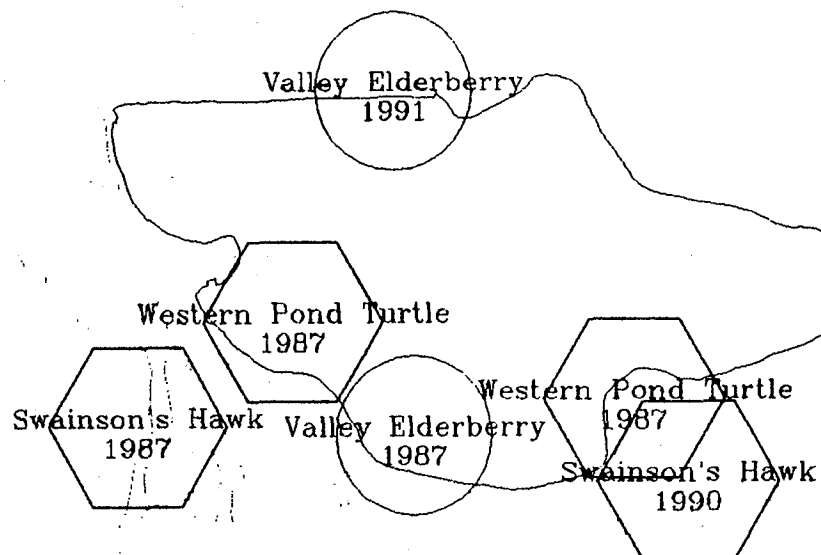
DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

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DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

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C-056753

C-056753



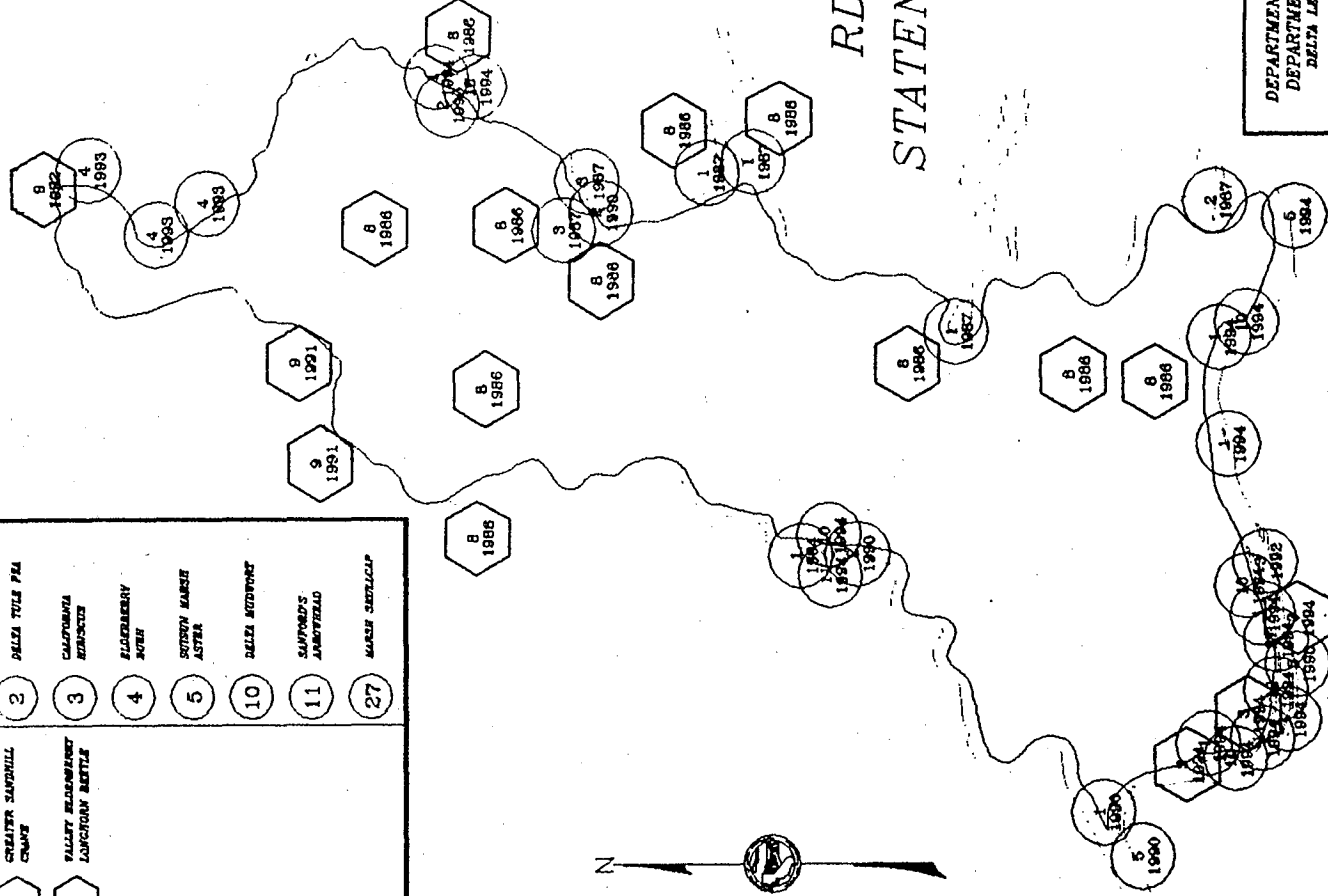
RD 2089  
STARK TRACT

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED: MARCH 1995

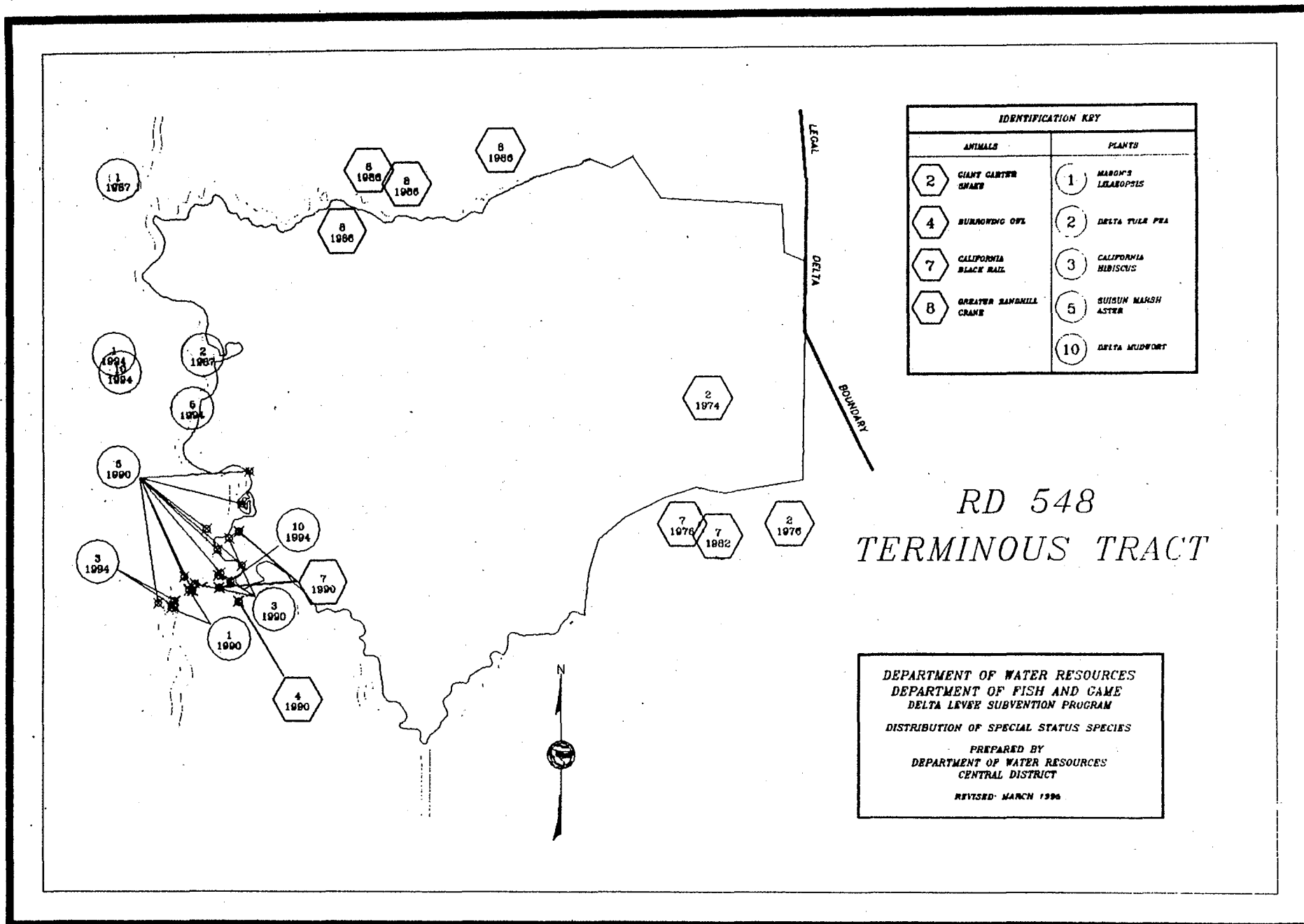
IDENTIFICATION KEY	
ANIMALS	PLANTS
3 WESTERN POND TURTLE	1 MASON'S LIAROSIS
8 CRAYTER SANDHILL CRANE	2 DELTA TULE PAL
9 VALLEY BLUEBERRY LONGTOON BATTLE	3 CALIFORNIA KUMONIA
	4 SAGEBRUSH WATER
	5 SUNSHIN MARSH ASTRA
	10 DELTA MUDWORM
	11 SANDFORD'S AMSTFIELD
	27 MARSH SATELLIP

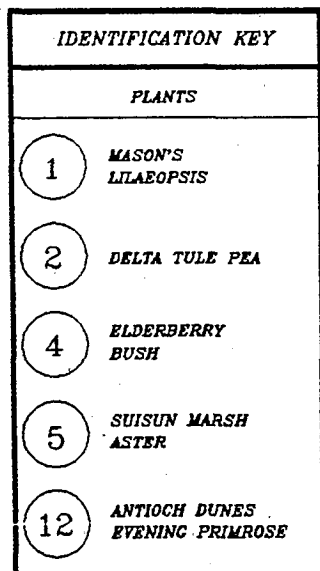


# RD 38 STATEN ISLAND

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES  
PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT  
REVISER: MARCH 1986







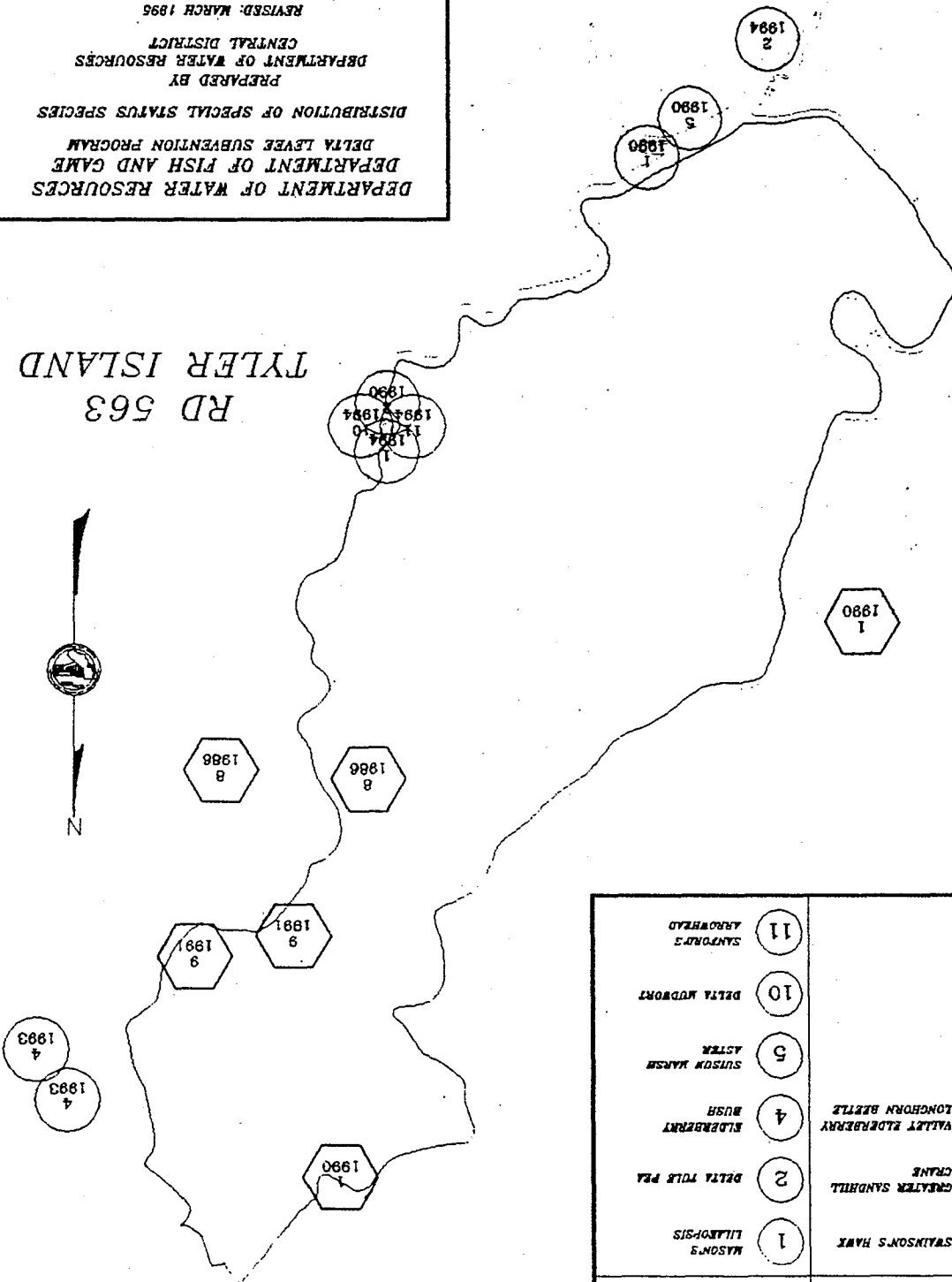
DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

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DEPARTMENT OF WATER RESOURCES  
 DEPARTMENT OF FISH AND GAME  
 DELTA LEVEE SUBVENTION PROGRAM  
 DISTRIBUTION OF SPECIAL STATUS SPECIES  
 PREPARED BY  
 CENTRAL DISTRICT  
 DEPARTMENT OF WATER RESOURCES  
 REVISED: MARCH 1995

RD 563  
 TYLER ISLAND

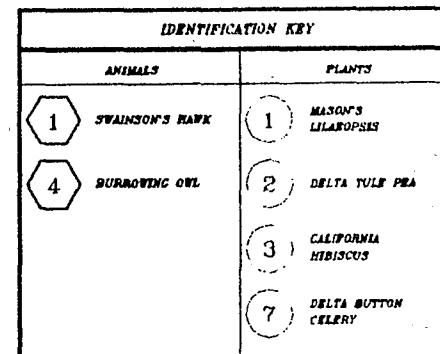


IDENTIFICATION KEY	
ANIMALS	PLANTS
1 SWANSON'S HAWK	1 MASON'S LILABOPSIS
2 CRANE	2 DELTA TULE PEA
3 GREATER SANDHILL	3 ELDERBERRY
4 LONGHORN BEETLE	4 BUSH
5 VALLEY ELDERBERRY	5 SUSON MARSH
6 ASTER	6 ASTER
7 DELTA WOODPORT	7 DELTA WOODPORT
8 SALTWATER	8 SALTWATER
9 SALTWATER	9 SALTWATER
10 SALTWATER	10 SALTWATER
11 SALTWATER	11 SALTWATER



DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES  
PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT  
REVISED. MARCH 1996

REVISID: MARCH 1995

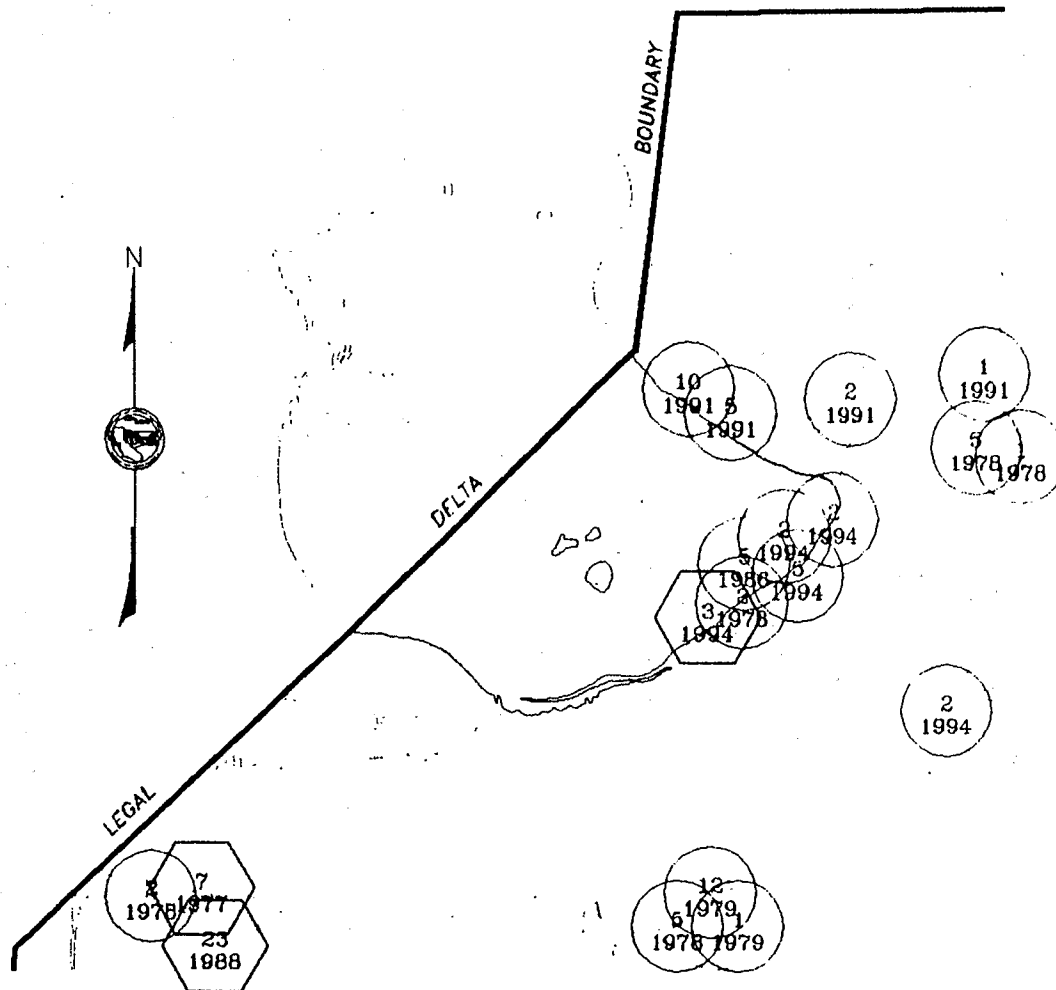


RD 2  
UNION ISLAND, WEST

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
DEPARTMENT OF WATER RESOURCES  
CENTRAL DISTRICT

REVISED, MARCH 1995



IDENTIFICATION KEY	
ANIMALS	PLANTS
3 WESTERN POND TURTLES	1 MASON'S LILIAOPSIS
7 CALIFORNIA BLACK RAIL	2 DELTA TULE PEA
23 CALIFORNIA LEAST TERN	5 SUISUN MARSH ASTER
	10 DELTA MUDWORT
	12 ANTIOCH DUNES EVENING PRIMROSE

RD 1607  
VAN SICKLE ISLAND

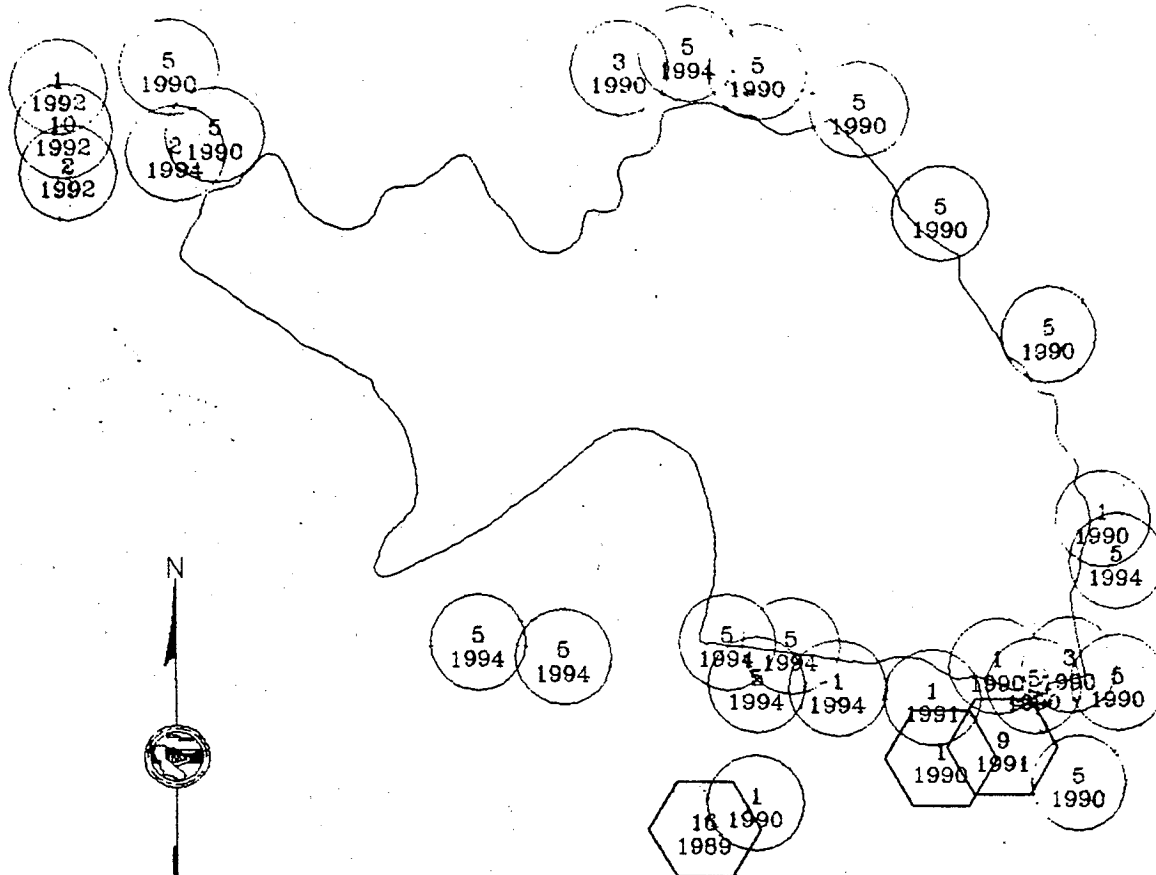
DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
DISTRIBUTION OF SPECIAL STATUS SPECIES

PREPARED BY  
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C-056761

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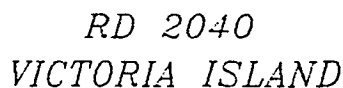
RD 2023  
VENICE ISLAND

IDENTIFICATION KEY	
ANIMALS	PLANTS
1 SWAINSON'S HAWK	1 MASON'S LILAEOPSIS
9 VALLEY ELDERBERRY LONGHORN BEETLE	2 DELTA TULE PEA
16 GREAT BLUE HERON	3 CALIFORNIA HIBISCUS
	5 SUISUN MARSH ASTER
	10 DELTA MUDWORT

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM  
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Valley Elderberry Longhorn Beetle  
1992

Valley Elderberry  
1992

Valley Elderberry  
1992

Valley Elderberry  
1992

Valley Elderberry  
1992

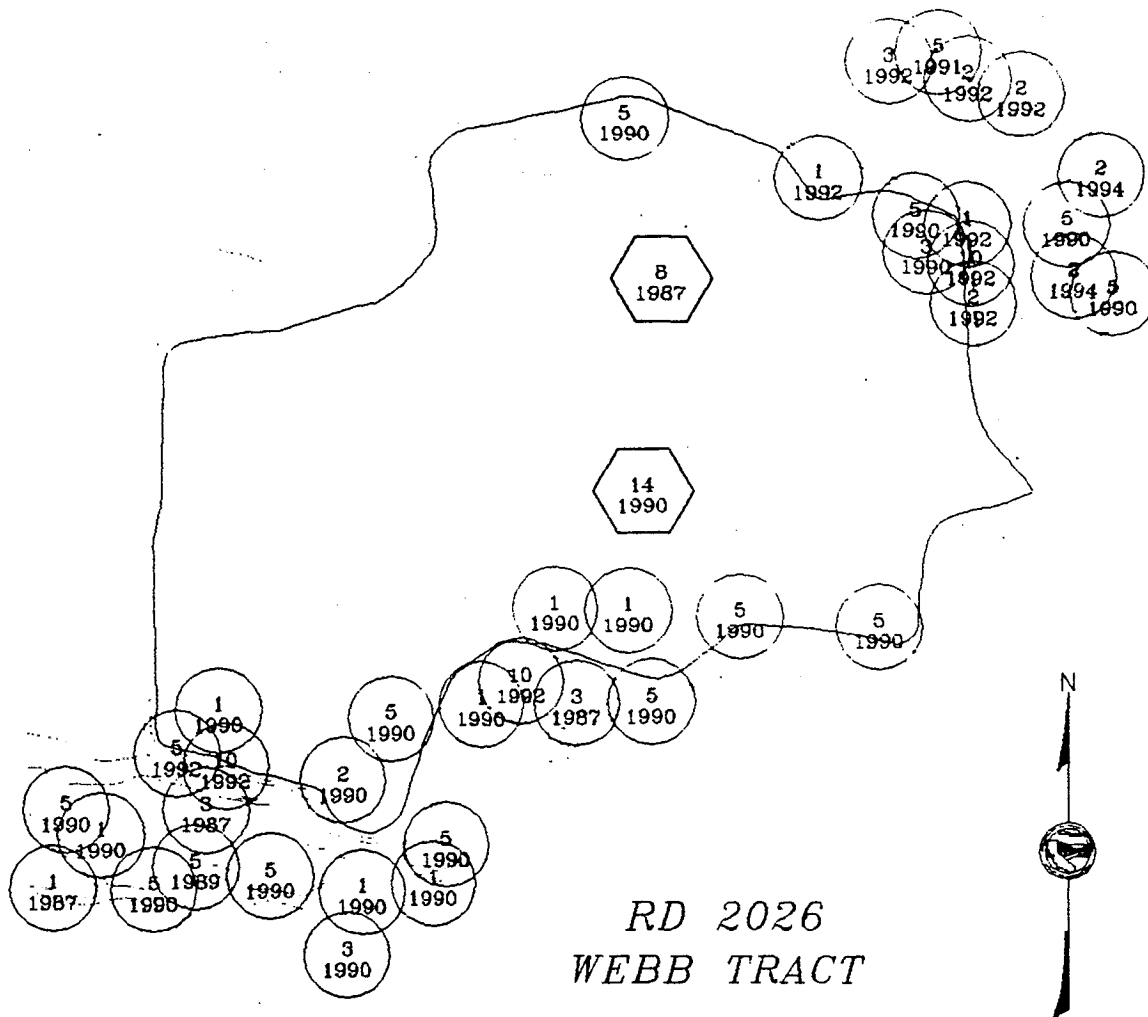
RD 554  
WALNUT GROVE



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RD 2026  
WEBB TRACT

IDENTIFICATION KEY	
ANIMALS	PLANTS
8 GREATER SANDHILL CRANE	1 MASON'S LEIAROPES
14 TRI-COLORED BLACKBIRD	2 DELTA TULE PEA
	3 CALIFORNIA HIBISCUS
	5 SUNSHINE MARSH ASTER
	10 DELTA MUDFOOT

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*RD 828  
WEBER TRACT*

Swainsons Hawk  
1892  
Calif Tiger Salamander  
1823  
Burrowing Owl  
1991



DEPARTMENT OF WATER RESOURCES  
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DELTA LEVEE SUBVENTION PROGRAM

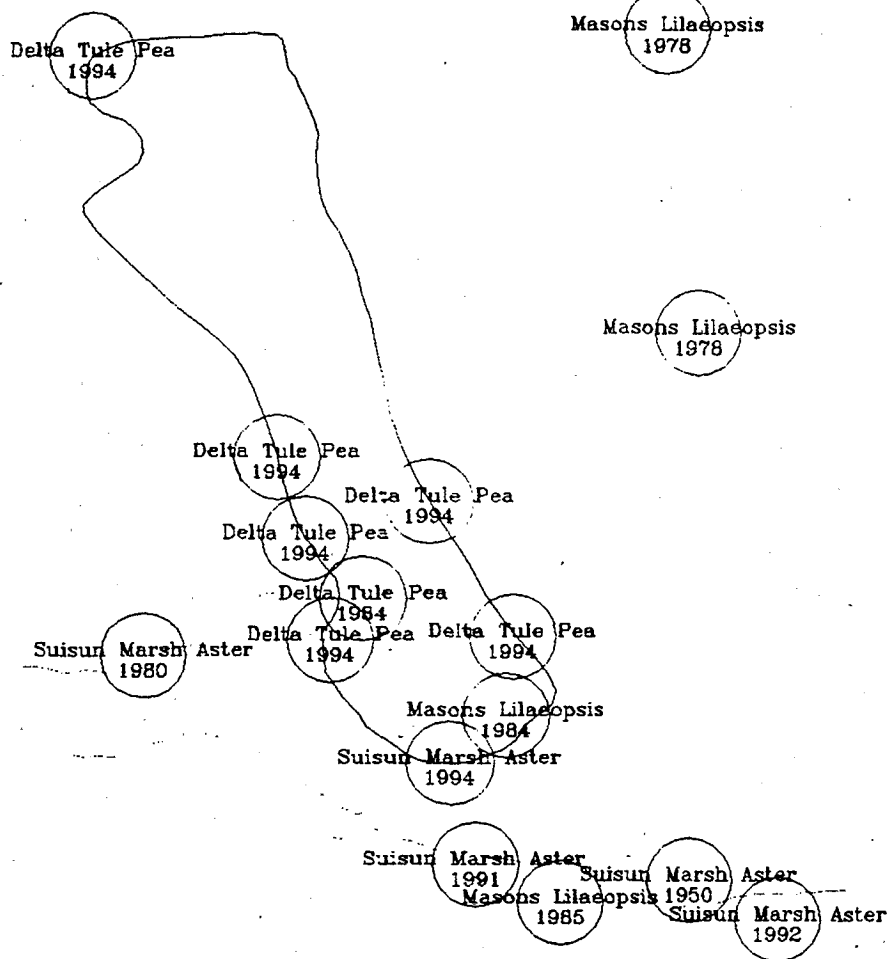
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RD 2122  
WINTER ISLAND

DEPARTMENT OF WATER RESOURCES  
DEPARTMENT OF FISH AND GAME  
DELTA LEVEE SUBVENTION PROGRAM

DISTRIBUTION OF SPECIAL STATUS SPECIES

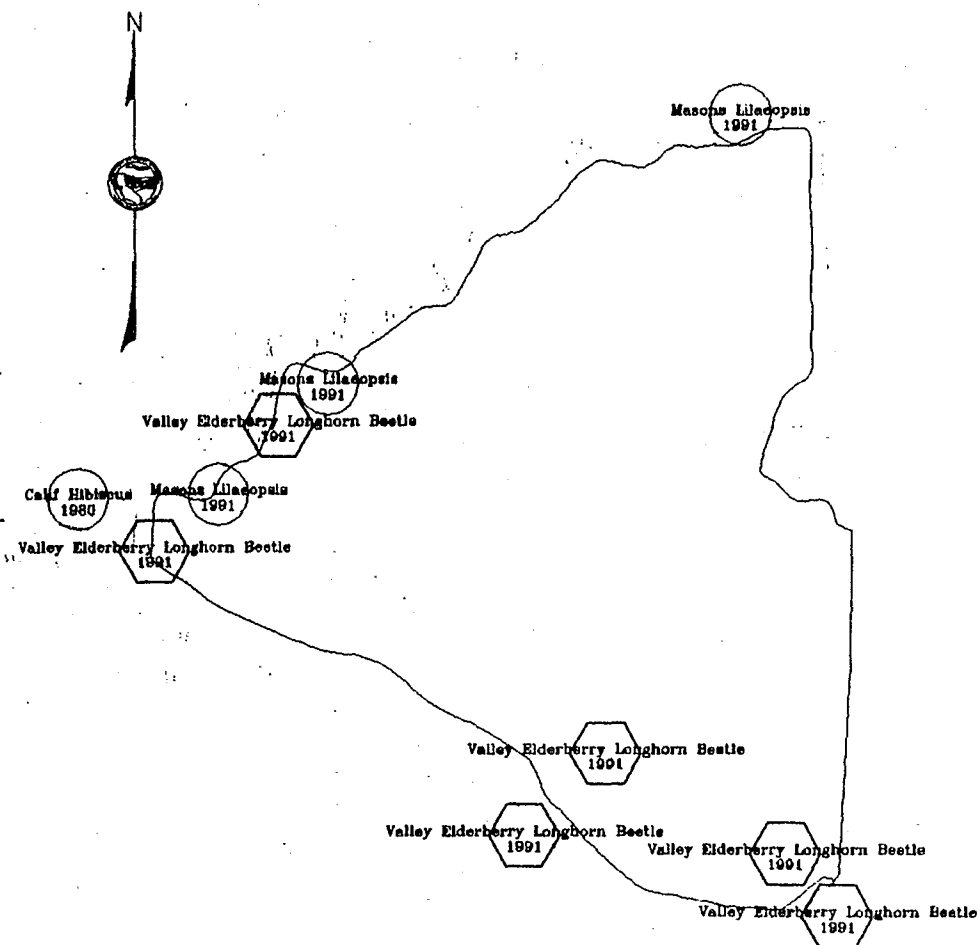
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RD 2072  
WOODWARD ISLAND

REVISÉ: MARCH 1995



# RD 2119 WRIGHT-ELMWOOD TRACT

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